User Manual

Allen-Bradley

Micro810™ Programmable Controllers

Catalog Numbers 2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual
- the purpose of this manual
- related documentation

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Micro800™controllers.

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Purpose of this Manual

This manual is a reference guide for Micro800 controllers, plug-in modules and accessories. It describes the procedures you use to install, wire, and troubleshoot your controller. This manual:

- explains how to install and wire your controllers
- gives you an overview of the Micro800 controller system

Refer to the Online Help provided with Connected Components Workbench™ (CCW) software for more information on programming your Micro800 controller.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Micro800 Programmable Controller External AC Power Supply Installation 2080-IN001	Information on mounting and wiring the optional external power supply.
Micro810 USB Adapter Plug-in Module Wirng Diagrams 2080-WD001	Information on mounting and wiring the Micro810 USB Adapter Plug-in Module.
Micro800 1.5" LCD Display and Keypad Module Wirng Diagrams 2080-WD009	Information on mounting and wiring the Micro800 1.5" LCD Display and Keypad Module.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://ab.com	Provides declarations of conformity, certificates, and other certification details.
Application Considerations for Solid-State Controls SGI-1.1	A description of important differences between solid-state programmable controller products and hard-wired electromechanical devices.
National Electrical Code - Published by the National Fire Protection Association of Boston, MA.	An article on wire sizes and types for grounding electrical equipment.
Allen-Bradley Industrial Automation Glossary AG-7.1	A glossary of industrial automation terms and abbreviations.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

You can download the latest version of Connected Components Workbench (CCW) for your Micro800 at the URL below.

http://ab.rockwellautomation.com/Programmable-Controllers/Connected-Components-Workbench-Software.

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Hardware Overview

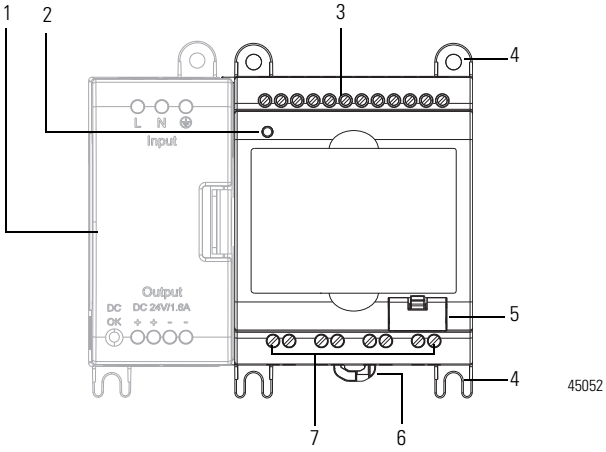
Hardware Features

The Micro800 controller is an economical brick style controller with embedded inputs and outputs.

Micro810 12-point controllers cannot use Micro800 plug-in modules, but do support a USB adapter, and an LCD module, which can be used as a backup memory module.

24V DC powered controllers accommodate any 24V DC output power supply that meets minimum specifications such as the optional Micro800 power supply (2080-LC10-12QWB, 2080-LC10-12QBB only).

Micro810 12-Point Controllers



Controller Description

	Description		Description
1	Optional power supply	5	USB port (for use with USB Adapter only)
2	Status indicator	6	DIN rail mounting latch
3	Input terminal block	7	Output terminal block
4	Mounting screw hole/ mounting foot		

Status Indicator

State	During Normal Operation	During Firmware Update or Program/Data Transfer
Off	No power applied to device, or in Fault mode	No power applied to device, or in Fault mode
Solid green	Device operating normally	Program transfer successful
Flashing green	Operating System error	Firmware update in progress

Micro810 Controllers

Catalog Number	Power	Inputs			Outputs		Analog In 0…10V (shared with DC In)
		120V AC	240V AC	12…24V DC /V AC	Relay	24 V DC SRC	
2080-LC10-12QWB	24V DC			8	4		4
2080-LC10-12AWA	120…240V AC	8			4		
2080-LC10-12QBB	12…24V DC			8		4	4
2080-LC10-12DWD	12V DC			8	4		4

About Your Controller

Agency Certifications

- UL Listed Industrial Control Equipment, certified for US and Canada. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada.
- CE marked for all applicable directives
- C-Tick marked for all applicable acts

Compliance to European Union Directives

This product has the CE mark and is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 2004/108/EC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
- EN 61131-2; Programmable Controllers (Clause 11)
- EN 61000-6-4
  EMC - Part 6-4: Generic Standards - Emission Standard for Industrial Environments
- EN 61000-6-2
  EMC - Part 6-2: Generic Standards - Immunity for Industrial Environments

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 2006/95/ECLow Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines for Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B115

Installation Considerations

Most applications require installation in an industrial enclosure (Pollution Degree 2(1)) to reduce the effects of electrical interference (Over Voltage Category II(2)) and environmental exposure. Locate your controller as far as possible from power lines, load lines, and other sources of electrical noise such as hard-contact switches, relays, and AC motor drives. For more information on proper grounding guidelines, see the Industrial Automation Wiring and Grounding Guidelines publication 1770-4.1.

(1) Pollution Degree 2 is an environment where normally only non-conductive pollution occurs except that occasionally temporary conductivity caused by condensation shall be expected.

(2) Overvoltage Category II is the load level section of the electrical distribution system. At this level, transient voltages are controlled and do not exceed the impulse voltage capability of the products insulation.

WARNING: If you insert or remove the module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding.

WARNING: The local programming terminal port is intended for temporary use only and must not be connected or disconnected unless the area is assured to be nonhazardous.

WARNING: When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.

WARNING: If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

WARNING: The USB port is intended for temporary local programming purposes only and not intended for permanent connection. If you connect or disconnect the USB cable with power applied to this module or any device on the USB network, an electrical arc can occur. This could cause an explosion in hazardous location installations.
Be sure that power is removed or the area is nonhazardous before proceeding.
The USB port is a nonincendive field wiring connection for Class I, Division2 Groups A, B, C and D.

WARNING: Exposure to some chemicals may degrade the sealing properties of materials used in the Relays. It is recommended that the User periodically inspect these devices for any degradation of properties and replace the module if degradation is found.

WARNING: To comply with the CE Low Voltage Directive (LVD), this equipment must be powered from a source compliant with the following:
Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).

WARNING: To comply with UL restrictions, this equipment must be powered from a source compliant with the following:
Class 2 or Limited Voltage/Current.

WARNING: Do not wire more than 2 conductors on any single terminal.

WARNING: Be careful when stripping wires. Wire fragments that fall into the controller could cause damage. Once wiring is complete, make sure the controller is free of all metal fragments.

ATTENTION: Do not remove the protective debris strips until after the controller and all other equipment in the panel near the module are mounted and wired. Remove strips before operating the controller. Failure to remove strips before operating can cause overheating.

ATTENTION: Electrostatic discharge can damage semiconductor devices inside the module. Do not touch the connector pins or other sensitive areas.

ATTENTION: This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the power supply's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded. Refer to Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1, for additional information.

ATTENTION: The USB cable is not to exceed 3.0 m (9.84 ft).

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see:

- Industrial Automation Wiring and Grounding Guidelines, Rockwell Automation publication 1770-4.1, for additional installation requirements.
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

Safety Considerations

Safety considerations are an important element of proper system installation. Actively thinking about the safety of yourself and others, as well as the condition of your equipment, is of primary importance. We recommend reviewing the following safety considerations.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:	**Informations sur l'utilisation de cet équipement en environnements dangereux:**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
EXPLOSION HAZARD • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of any component may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**RISQUE D'EXPLOSION** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de tout composant peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Disconnecting Main Power

WARNING: Explosion Hazard
Do not replace components, connect equipment, or disconnect equipment unless power has been switched off.

The main power disconnect switch should be located where operators and maintenance personnel have quick and easy access to it. In addition to disconnecting electrical power, all other sources of power (pneumatic and hydraulic) should be de-energized before working on a machine or process controlled by a controller.

Safety Circuits

WARNING: Explosion Hazard
Do not connect or disconnect connectors while circuit is live.

Circuits installed on the machine for safety reasons, like overtravel limit switches, stop push buttons, and interlocks, should always be hard-wired directly to the master control relay. These devices must be wired in series so that when any one device opens, the master control relay is de-energized, thereby removing power to the machine. Never alter these circuits to defeat their function. Serious injury or machine damage could result.

Power Distribution

There are some points about power distribution that you should know:

- The master control relay must be able to inhibit all machine motion by removing power to the machine I/O devices when the relay is de-energized. It is recommended that the controller remain powered even when the master control relay is de-energized.
- If you are using a DC power supply, interrupt the load side rather than the AC line power. This avoids the additional delay of power supply turn-off. The DC power supply should be powered directly from the fused secondary of the transformer. Power to the DC input and output circuits should be connected through a set of master control relay contacts.

Periodic Tests of Master Control Relay Circuit

Any part can fail, including the switches in a master control relay circuit. The failure of one of these switches would most likely cause an open circuit, which would be a safe power-off failure. However, if one of these switches shorts out, it no longer provides any safety protection. These switches should be tested periodically to assure they will stop machine motion when needed.

Power Considerations

The following explains power considerations for the micro controllers.

Isolation Transformers

You may want to use an isolation transformer in the AC line to the controller. This type of transformer provides isolation from your power distribution system to reduce the electrical noise that enters the controller and is often used as a step-down transformer to reduce line voltage. Any transformer used with the controller must have a sufficient power rating for its load. The power rating is expressed in volt-amperes (VA).

Power Supply Inrush

During power-up, the Micro800 power supply allows a brief inrush current to charge internal capacitors. Many power lines and control transformers can supply inrush current for a brief time. If the power source cannot supply this inrush current, the source voltage may sag momentarily.

The only effect of limited inrush current and voltage sag on the Micro800 is that the power supply capacitors charge more slowly. However, the effect of a voltage sag on other equipment should be considered. For example, a deep voltage sag may reset a computer connected to the same power source. The following considerations determine whether the power source must be required to supply high inrush current:

- The power-up sequence of devices in a system.
- The amount of the power source voltage sag if the inrush current cannot be supplied.
- The effect of voltage sag on other equipment in the system.

If the entire system is powered-up at the same time, a brief sag in the power source voltage typically will not affect any equipment.

Loss of Power Source

The power supply is designed to withstand brief power losses without affecting the operation of the system. The time the system is operational during power loss is called program scan hold-up time after loss of power. The duration of the power supply hold-up time depends on the type and state of the I/O, but is typically between 10 milliseconds and 3 seconds. When the duration of power loss reaches this limit, the power supply signals the processor that it can no longer provide adequate DC power to the system. This is referred to as a power supply shutdown. The processor then performs an orderly shutdown of the controller.

Input States on Power Down

The power supply hold-up time as described above is generally longer than the turn-on and turn-off times of the inputs. Because of this, the input state change from "On" to "Off" that occurs when power is removed may be recorded by the processor before the power supply shuts down the system. Understanding this concept is important. The user program should be written to take this effect into account.

Other Types of Line Conditions

Occasionally the power source to the system can be temporarily interrupted. It is also possible that the voltage level may drop substantially below the normal line voltage range for a period of time. Both of these conditions are considered to be a loss of power for the system.

Preventing Excessive Heat

For most applications, normal convective cooling keeps the controller within the specified operating range. Ensure that the specified temperature range is maintained. Proper spacing of components within an enclosure is usually sufficient for heat dissipation.

In some applications, a substantial amount of heat is produced by other equipment inside or outside the enclosure. In this case, place blower fans inside the enclosure to assist in air circulation and to reduce "hot spots" near the controller.

Additional cooling provisions might be necessary when high ambient temperatures are encountered.

TIP Do not bring in unfiltered outside air. Place the controller in an enclosure to protect it from a corrosive atmosphere. Harmful contaminants or dirt could cause improper operation or damage to components. In extreme cases, you may need to use air conditioning to protect against heat build-up within the enclosure.

Master Control Relay

A hard-wired master control relay (MCR) provides a reliable means for emergency machine shutdown. Since the master control relay allows the placement of several emergency-stop switches in different locations, its installation is important from a safety standpoint. Overtravel limit switches or mushroom-head push buttons are wired in series so that when any of them opens, the master control relay is de-energized. This removes power to input and output device circuits. Refer to the figures on pages 13 and 14.

WARNING: Never alter these circuits to defeat their function since serious injury and/or machine damage could result.

TIP If you are using an external DC power supply, interrupt the DC output side rather than the AC line side of the supply to avoid the additional delay of power supply turn-off.

The AC line of the DC output power supply should be fused.

Connect a set of master control relays in series with the DC power supplying the input and output circuits.

Place the main power disconnect switch where operators and maintenance personnel have quick and easy access to it. If you mount a disconnect switch inside the controller enclosure, place the switch operating handle on the outside of the enclosure, so that you can disconnect power without opening the enclosure.

Whenever any of the emergency-stop switches are opened, power to input and output devices should be removed.

When you use the master control relay to remove power from the external I/O circuits, power continues to be provided to the controller's power supply so that diagnostic indicators on the processor can still be observed.

The master control relay is not a substitute for a disconnect to the controller. It is intended for any situation where the operator must quickly de-energize I/O devices only. When inspecting or installing terminal connections, replacing output fuses, or working on equipment within the enclosure, use the disconnect to shut off power to the rest of the system.

TIP Do not control the master control relay with the controller. Provide the operator with the safety of a direct connection between an emergency-stop switch and the master control relay.

Using Emergency-Stop Switches

When using emergency-stop switches, adhere to the following points:

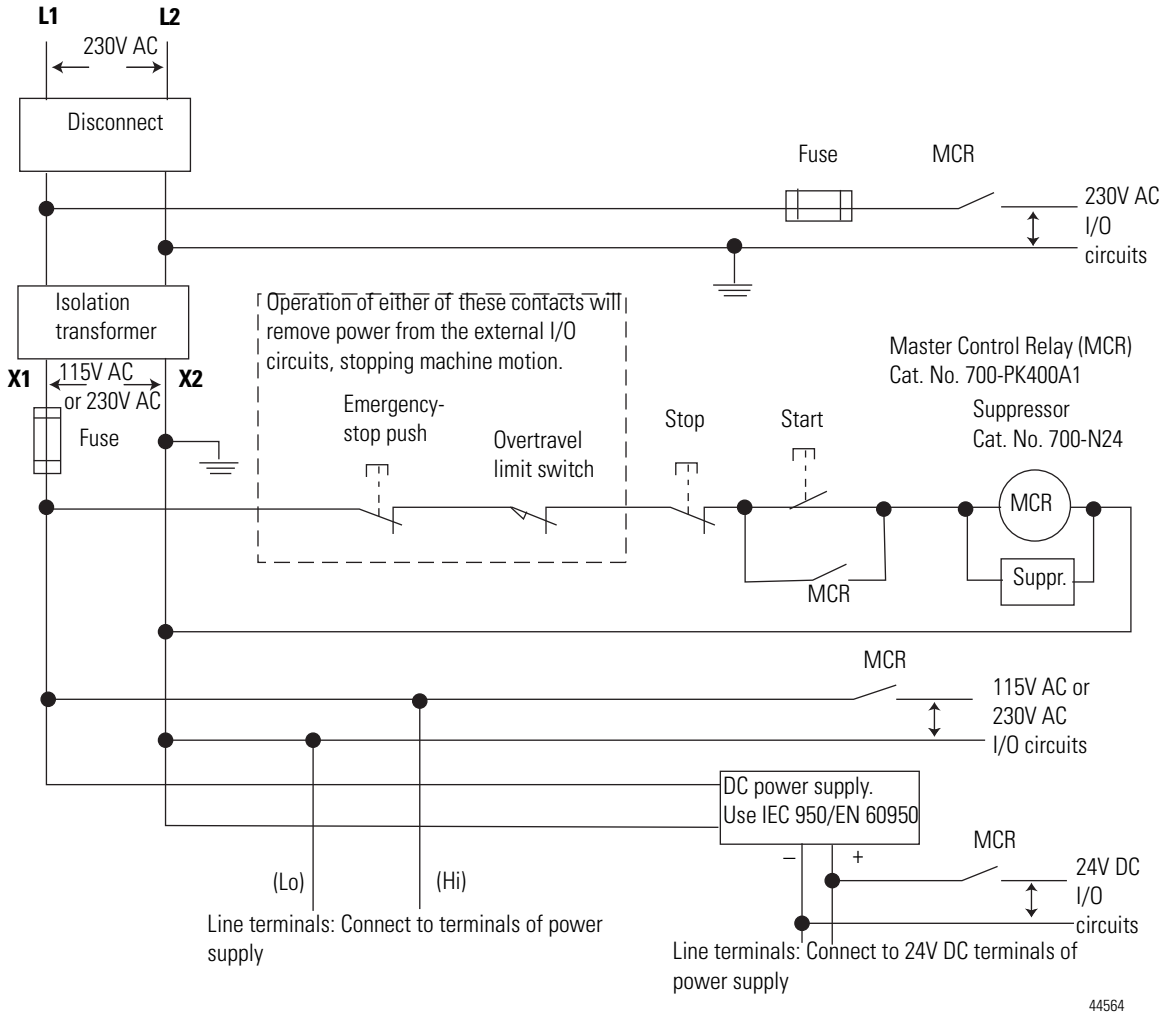
- Do not program emergency-stop switches in the controller program. Any emergency-stop switch should turn off all machine power by turning off the master control relay.
- Observe all applicable local codes concerning the placement and labeling of emergency-stop switches.

- Install emergency-stop switches and the master control relay in your system. Make certain that relay contacts have a sufficient rating for your application. Emergency-stop switches must be easy to reach.
- In the following illustration, input and output circuits are shown with MCR protection. However, in most applications, only output circuits require MCR protection.

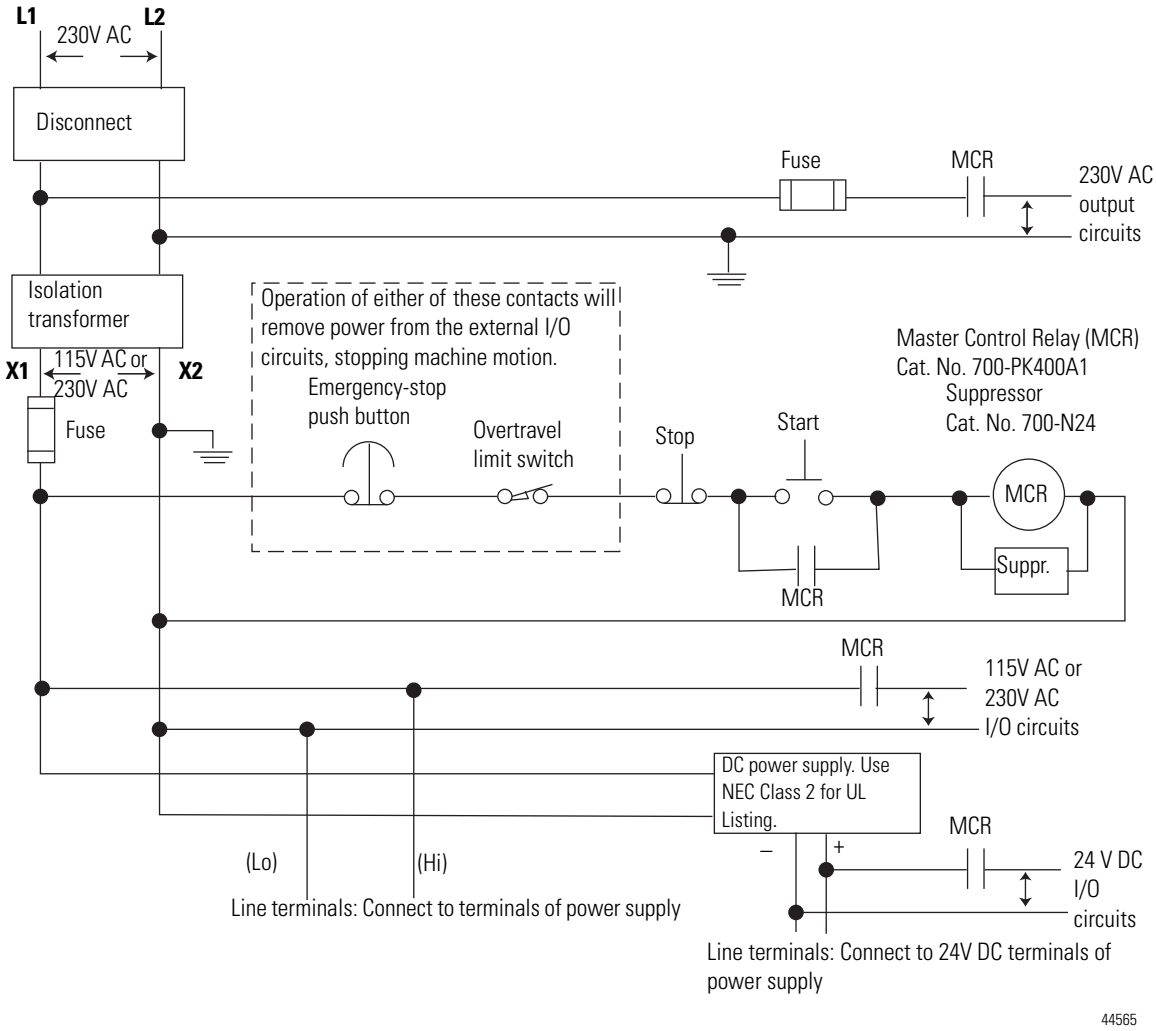
The following illustrations show the Master Control Relay wired in a grounded system.

TIP In most applications input circuits do not require MCR protection; however, if you need to remove power from all field devices, you must include MCR contacts in series with input power wiring.

Schematic (Using IEC Symbols)



Schematic (Using ANSI/CSA Symbols)



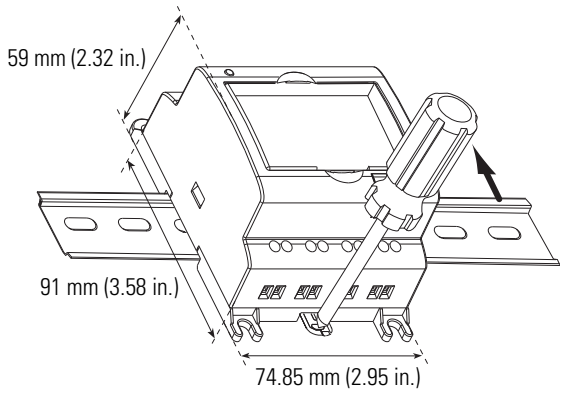
Install Your Controller

Controller Mounting Dimensions

Mounting Dimensions

Mounting dimensions do not include mounting feet or DIN rail latches.

Micro810 Controllers
2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12QBB, 2080-LC10-12DWD



Module Spacing

Maintain spacing from objects such as enclosure walls, wireways and adjacent equipment. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation. An exception to this spacing guideline is allowed for the side at which you are connecting the optional power supply, 2080-PS120-240VAC.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm x 1 mm (EN 50 022 - 35 x 7.5).

TIP For environments with greater vibration and shock concerns, use the panel mounting method, instead of DIN rail mounting.

Before mounting the module on a DIN rail, use a flat-blade screwdriver in the DIN rail latch and pry it downwards until it is in the unlatched position.

1. Hook the top of the DIN rail mounting area of the controller onto the DIN rail, and then press the bottom until the controller snaps onto the DIN rail.
2. Push the DIN rail latch back into the latched position.
   Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-EAHJ35) for vibration or shock environments.

To remove your controller from the DIN rail, pry the DIN rail latch downwards until it is in the unlatched position.

Panel Mounting

The preferred mounting method is to use four M4 (#8) screws per module. Hole spacing tolerance: ±0.4 mm (0.016 in.).

Follow these steps to install your controller using mounting screws.

1. Place the controller against the panel where you are mounting it. Make sure the controller is spaced properly.
2. Mark drilling holes through the mounting screw holes and mounting feet then remove the controller.
3. Drill the holes at the markings, then replace the controller and mount it. Leave the protective debris strip in place until you are finished wiring the controller and any other devices.

Wire Your Controller

Wiring Requirements

WARNING: Before you install and wire any device, disconnect power to the controller system.

WARNING: Calculate the maximum possible current in each power and common wire. Observe all electrical codes dictating the maximum current allowable for each wire size. Current above the maximum ratings may cause wiring to overheat, which can cause damage. *United States Only*: If the controller is installed within a potentially hazardous environment, all wiring must comply with the requirements stated in the National Electrical Code 501-10 (b).

- Allow for at least 50 mm. (2 in.) between I/O wiring ducts or terminal strips and the controller.
- Route incoming power to the controller by a path separate from the device wiring. Where paths must cross, their intersection should be perpendicular.

TIP Do not run signal or communications wiring and power wiring in the same conduit. Wires with different signal characteristics should be routed by separate paths.

- Separate wiring by signal type. Bundle wiring with similar electrical characteristics together.
- Separate input wiring from output wiring.
- Label wiring to all devices in the system. Use tape, shrink-tubing, or other dependable means for labeling purposes. In addition to labeling, use colored insulation to identify wiring based on signal characteristics. For example, you may use blue for DC wiring and red for AC wiring.

Wire Requirements

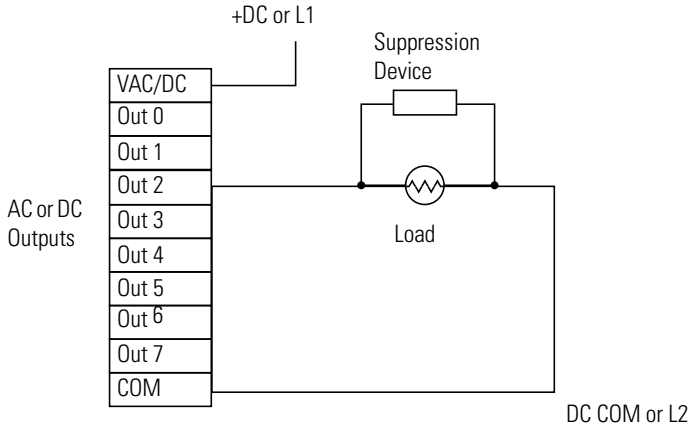
	Wire Size
Micro810 Controllers	0.32... 2.1 mm² (22...14 AWG) solid copper wire or 0.32... 1.3 mm² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max.

Using Surge Suppressors

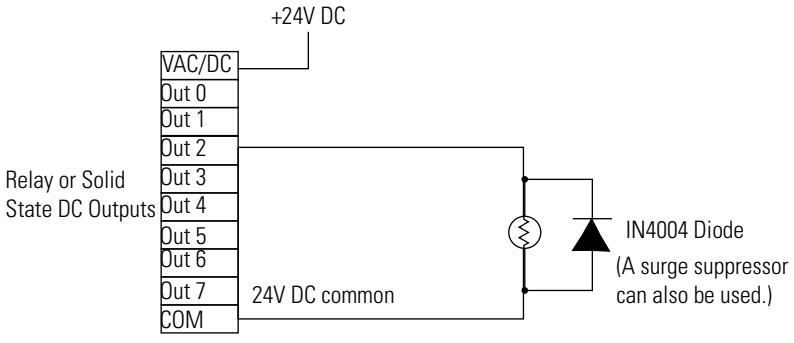
Because of the potentially high current surges that occur when switching inductive load devices, such as motor starters and solenoids, the use of some type

of surge suppression to protect and extend the operating life of the controllers output contacts is required. Switching inductive loads without surge suppression can *significantly* reduce the life expectancy of relay contacts. By adding a suppression device directly across the coil of an inductive device, you prolong the life of the output or relay contacts. You also reduce the effects of voltage transients and electrical noise from radiating into adjacent systems.

The following diagram shows a typical PLC's output with a suppression device. We recommend that you locate the suppression device as close as possible to the load device.



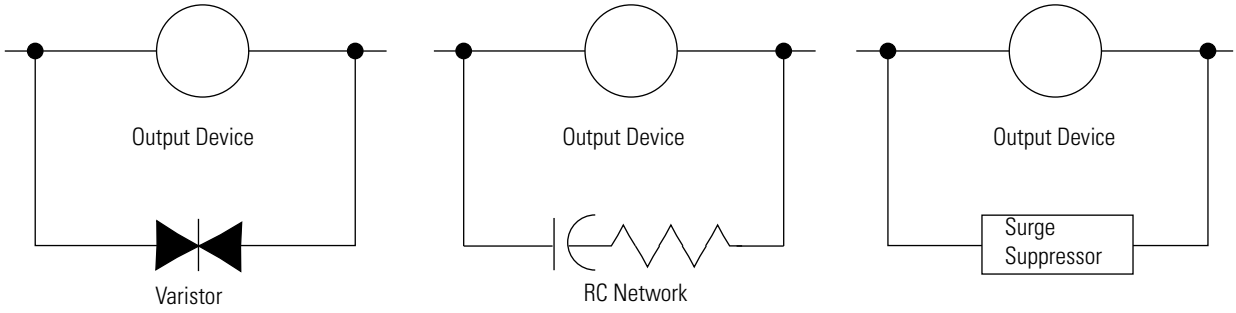
If the outputs are DC, we recommend that you use an 1N4004 diode for surge suppression, as shown below. For inductive DC load devices, a diode is suitable. A 1N4004 diode is acceptable for most applications. A surge suppressor can also be used. See page 19 for recommended suppressors. As shown below with a typical PLC's output, these surge suppression circuits connect directly across the load device.



Suitable surge suppression methods for inductive AC load devices include a varistor, an RC network, or an Allen-Bradley surge suppressor, all shown below. These components must be appropriately rated to suppress the switching

transient characteristic of the particular inductive device. See Recommended Surge Suppressors on page 19 for recommended suppressors.

Surge Suppression for Inductive AC Load Devices



Recommended Surge Suppressors

Use the Allen-Bradley surge suppressors shown in the following table for use with relays, contactors, and starters.

Recommended Surge Suppressors

Device	Coil Voltage	Suppressor Catalog Number
Bulletin 509 Motor Starter Bulletin 509 Motor Starter	120V AC 240V AC	599-K04(1) 599-KA04(1)
Bulletin 100 Contactor Bulletin 100 Contactor	120V AC 240V AC	199-FSMA1(2) 199-FSMA2(2)
Bulletin 709 Motor Starter	120V AC	1401-N10(2)
Bulletin 700 Type R, RM Relays	AC coil	None Required
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	12V DC 12V DC	199-FSMA9
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	24V DC 24V DC	199-FSMA9
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	48V DC 48V DC	199-FSMA9
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	115-125V DC 115-125V DC	199-FSMA10
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	230-250V DC 230-250V DC	199-FSMA11
Bulletin 700 Type N, P, or PK Relay	150V max, AC or DC	700-N24(2)
Miscellaneous electromagnetic devices limited to 35 sealed VA	150V max, AC or DC	700-N24(2)

(1) Varistor – Not recommended for use on relay outputs.
(2) RC Type – Do not use with Triac outputs.

Ground the Controller

This product is intended to be mounted to a well grounded mounting surface such as a metal panel. Refer to the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional information. Additional grounding connections from the mounting tab or DIN rail, if used, are not required unless the mounting surface cannot be grounded.

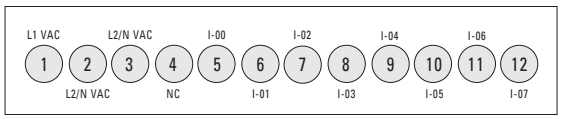
Wiring Diagrams

The following illustrations show the wiring diagrams for the Micro800 controllers. For controllers with DC inputs, inputs 0...3 can be wired as either sinking or sourcing inputs, however, inputs 4...7 can only be wired as sinking inputs. Sinking and sourcing does not apply to AC inputs.

Micro810 Controllers

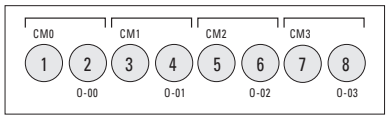
2080-LC10-12AWA

Input Terminal Block



45055

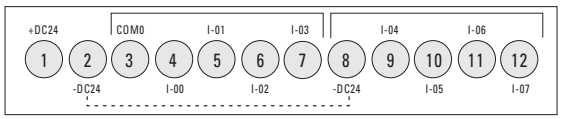
Output Terminal Block



45059

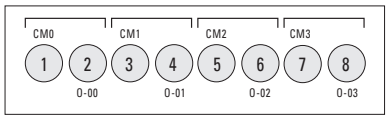
2080-LC10-12QWB

Input Terminal Block(1)



45056

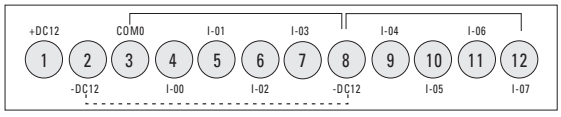
Output Terminal Block



45059

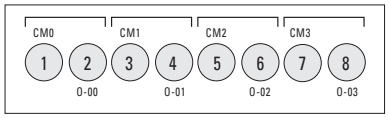
2080-LC10-12DWD

Input Terminal Block(1)



45057

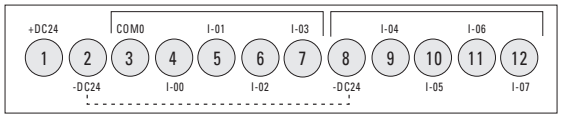
Output Terminal Block



45059

2080-LC10-12QBB

Input Terminal Block(1)



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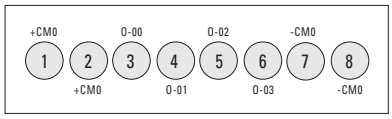
Output Terminal Block



45058

[1] I-04, I-05, I-06, I-07 apply as both digital inputs 4, 5, 6, 7 and analog inputs 0, 1, 2, 3 for the 2080-LC10-QWB, 2080-LC10-12DWD, and 2080-LC10-12QBB models.

Controller I/O Wiring

Minimize Electrical Noise

Because of the variety of applications and environments where controllers are installed and operating, it is impossible to ensure that all environmental noise will be removed by input filters. To help reduce the effects of environmental noise,

install the Micro800 system in a properly rated (for example, NEMA) enclosure. Make sure that the Micro800 system is properly grounded.

A system may malfunction due to a change in the operating environment after a period of time. We recommend periodically checking system operation, particularly when new machinery or other noise sources are installed near the Micro800 system.

Analog Channel Wiring Guidelines

Consider the following when wiring your analog channels:

- The analog common (COM) is connected to power supply common inside the module. These terminals are not electrically isolated from the system.
- Analog channels are not isolated from each other.
- Use Belden 8761, or equivalent, shielded wire.
- Under normal conditions, the drain wire (shield) should be connected to the metal mounting panel at field side (earth ground). Keep the shield connection to earth ground as short as possible.
- To ensure optimum accuracy for voltage type inputs, limit overall cable impedance by keeping all analog cables as short as possible. Locate the I/O system as close to your voltage type sensors or actuators as possible.

Minimize Electrical Noise on Analog Channels

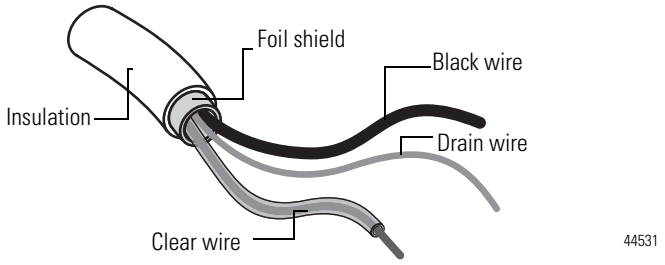
Inputs on analog channels employ digital high-frequency filters that significantly reduce the effects of electrical noise on input signals. However, because of the variety of applications and environments where analog controllers are installed and operated, it is impossible to ensure that all environmental noise will be removed by the input filters.

Several specific steps can be taken to help reduce the effects of environmental noise on analog signals:

- install the Micro800 system in a properly rated enclosure, for example, NEMA. Make sure that the Micro800 system is properly grounded.
- use Belden cable #8761 for wiring the analog channels, making sure that the drain wire and foil shield are properly earth grounded.
- route the Belden cable separately from any AC wiring. Additional noise immunity can be obtained by routing the cables in grounded conduit.

Ground Your Analog Cable

Use shielded communication cable (Belden #8761). The Belden cable has two signal wires (black and clear), one drain wire, and a foil shield. The drain wire and foil shield must be grounded at one end of the cable.

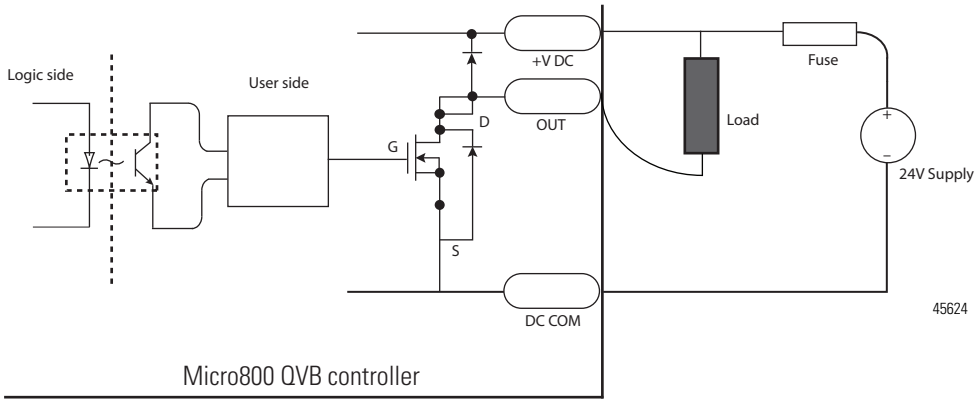


IMPORTANT Ground the drain wire and foil shield at field side.

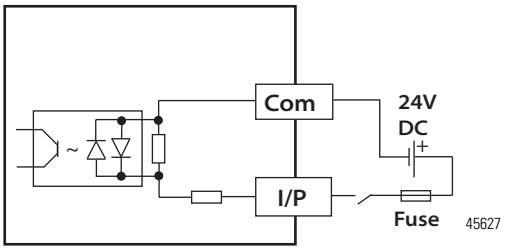
Wiring Examples

Examples of sink/source, input/output wiring are shown below.

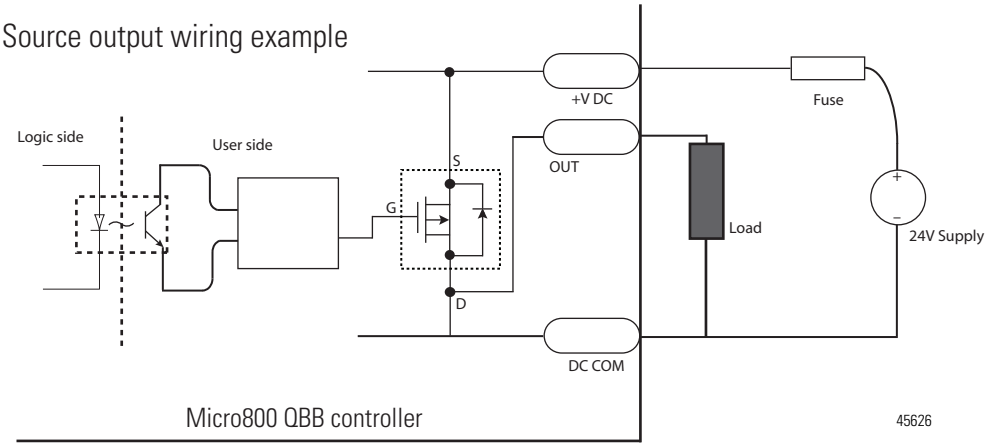
Sink output wiring example



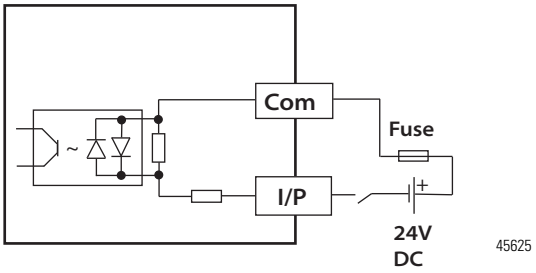
Sink input wiring example



Source output wiring example



Source input wiring example



About Accessories

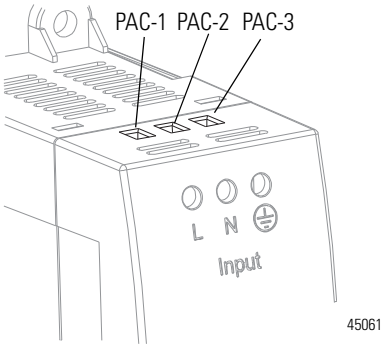
Accessories

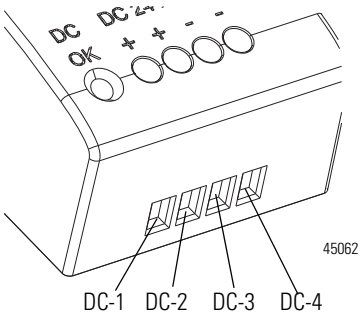
This chapter highlights the accessories you can use with the Micro810 controller.

External AC Power Supply

Use this optional power supply (2080-PS120-240VAC) in applications with smaller systems when a 24V DC power supply is not readily available.

Wire the Module





AC Input Connectors				DC Output Connectors (DC 24V/ 1.6 A)		
PAC-1	AC hot	100…240V AC		DC-1	+	
PAC-2	AC neutral	100…240V AC		DC-2	+	
PAC-3	Safety ground			DC-3	-	
				DC-4	-	

1.5" LCD Display and Keypad Module

This module (2080-LCD) also functions as a backup memory module for the Micro810 controller.

This module offers an affordable and simple method of viewing status and configuring the Micro810 Controller. With this LCD module, you can also modify core Smart Relay function blocks.

The LCD Display instructions can be used to display custom messages as well as to read keystrokes.

This module may be inserted or removed when power is applied to the controller, but only in non-hazardous locations. Be sure that power is removed or the area is nonhazardous before proceeding.

Insert the LCD Module

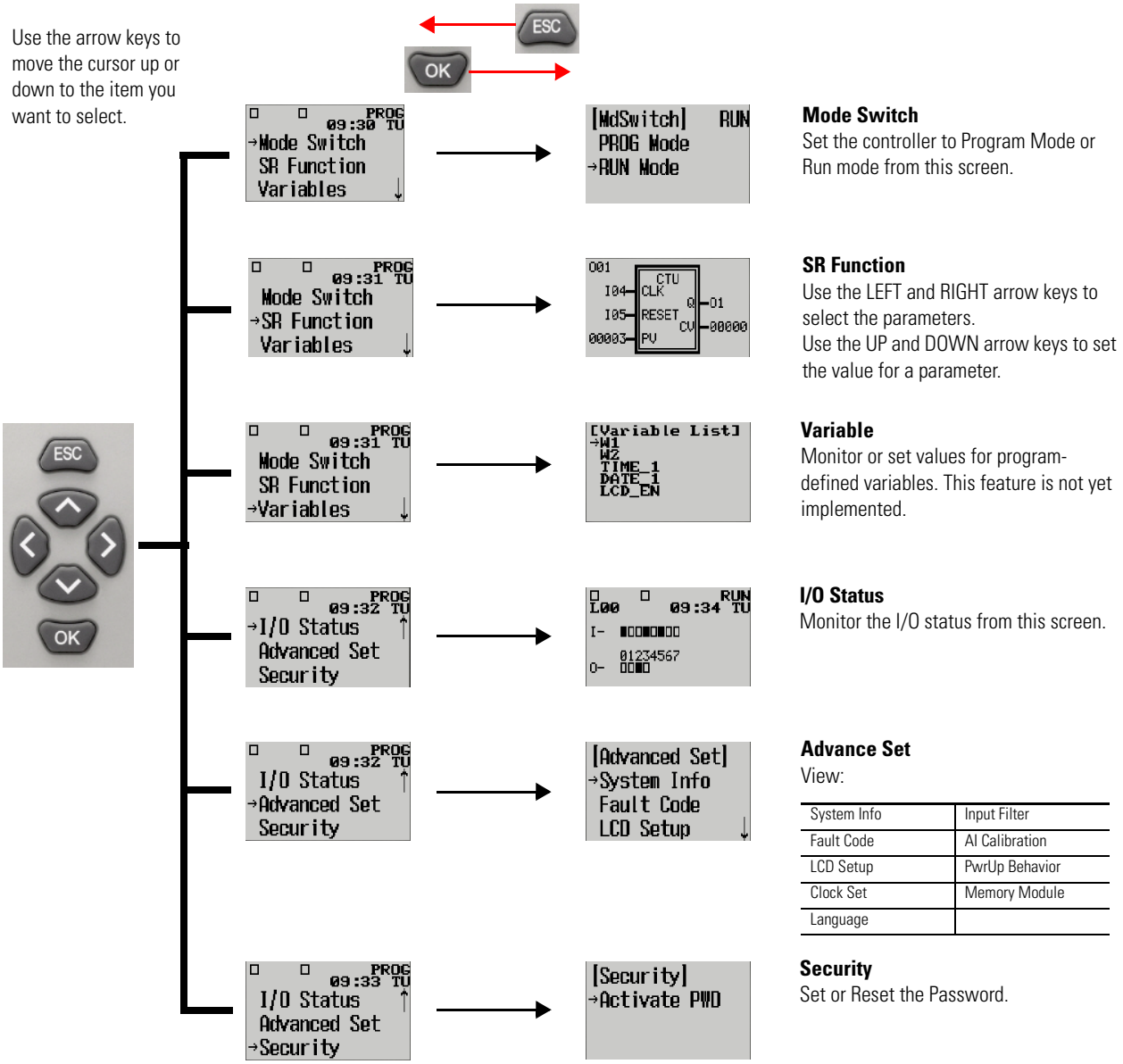
1. Remove blank cover plate .
2. Push in the LCD module until it latches on the top and bottom.

Remove the LCD Module

1. Squeeze the top and bottom latches, then pull out the top first, then the bottom.

Access the Main Menu

Press the ESC and OK buttons at the same time to access the Main Menu screen.



Mode Switch
Set the controller to Program Mode or Run mode from this screen.

SR Function
Use the LEFT and RIGHT arrow keys to select the parameters.
Use the UP and DOWN arrow keys to set the value for a parameter.

Variable
Monitor or set values for program-defined variables. This feature is not yet implemented.

I/O Status
Monitor the I/O status from this screen.

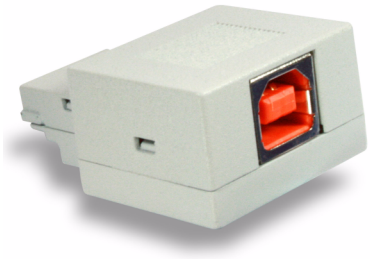
Advance Set
View:

System Info	Input Filter
Fault Code	AI Calibration
LCD Setup	PwrUp Behavior
Clock Set	Memory Module
Language	

Security
Set or Reset the Password.

USB Adapter

This module (2080-USBADAPTER) provides the Micro810 controller with a USB port.



Use a standard USB A Male to B Male cable for programming the controller.

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Specifications

Micro810 Controllers

General - 2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC1012DWD, 2080-LC10-12QBB

Attribute	2080-LC10-12AWA	2080-LC10-12QWB	2080-LC1012DWD	2080-LC10-12QBB
Number of I/O	8 Input (4 digital, 4 analog/digital, configurable) 4 Output			
Dimensions HxWxD	91 x 75 x 59 mm (3.58 x 2.95 x 2.32 in.)			
Supply voltage range	85V…263V	20.4…26.4V DC	10.8V…13.2V DC	11.4V..26.4V DC
Supply frequency range (AC supply)	47…63 Hz	N.A.		
Voltage range	100…240V AC, 50/60 Hz	24V DC Class 2	12V DC Class 2	12/24V DC Class 2
Power consumption	5V A	3 W		
I/O rating	Input: 120…240V AC Output: Relay 00 & 01: 8 A @ 240V AC, B300, R300, General Use Relay 02 & 03: 4 A @ 240V AC, C300, R150, General Use	Input: 24V DC, 8 mA	Input: 12V DC, 8 mA	Input: 24V DC, 8 mA Output: 24V DC 1A, 25 °C, 24V DC 0.5A 55°C
Shipping weight, approx.	0.203 kg (0.448 lb)			
Wire size	0.32... 2.1 mm² (22...14 AWG) solid copper wire or 0.32... 1.3 mm² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max.			
Wiring category[1]	2 - on signal ports 2 - on power ports			
Wiring torque	1.085 Nm (8 lb-in)			
Wire type	use Copper Conductors only			
Fuse, type	Rated 250V 3.15 A-RADIAL			
Enclosure type rating	Meets IP20			
North American temp code	T5			
Insulation stripping length	7 mm (0.28 in)			
Isolation voltage	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs. Type tested for 60 s 3250V DC, I/O to Aux and Network, Inputs to Outputs	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, Inputs to Aux and Network, 3250V DC Outputs to Aux and Network, Inputs to Outputs		50V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, I/O to Aux and Network, Inputs to Outputs
AC input filter setting	16 ms for all embedded inputs (In CCW, go to the Embedded I/O configuration window to re-configure the filter setting for each input group			

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Non-isolated AC Inputs (2080-LC10-12AWA)

Attribute	Value
On-state voltage, nom	120/240 V AC
On-state voltage, min	79 V AC
On-state voltage, max	265 V AC
Off-state voltage, max	40 V AC
Off-state current, max	0.095 mA
Operating frequency, nom	50/60 Hz
Input impedence	423.7 kΩ
Operating frequency	47…63 Hz

DC Inputs (2080-LC10-12QWB, -12QBB, -12DWD)

Attribute	Non-isolated, shared with analog inputs (Inputs 4…7)	Isolated (Inputs 0…3)
Voltage category	24V DC sink/source	
On-state voltage, nom	12/24V DC	
On-state voltage, min	9.8V DC	
On-state voltage, max	28.8V DC	
Off-state voltage, max	5V DC	
Off-state current, max	0.5 mA	1.5 mA
On-state current, min	0.75 mA @ 10.8V DC 1.0 mA @ 15 V DC	1.8 mA @ 10.8V DC 2.7 mA @ 15 V DC
On-state current, nom	2.1 mA @ 24V DC	6 mA @ 24V DC
On-state current, max	2.7 mA @ 28.8 V DC	7.5 mA @ 28.8 V DC
Nominal impedance	14.1 kΩ(non-isolated)	3.74 kΩ(isolated)
IEC input compatibility	Type 1	Type 3

Analog Inputs (2080-LC10-12QWB, -12QBB, -12DWD) (Inputs 4…7)

Attribute	Value
Input type	DC voltage
Input voltage range	0…10V DC
Input voltage, max	26.4V DC
Value of LSB	10 mV
Input resolution	10-bit
Input data count range	0…1023
Smoothing	None, smoothing
Overall accuracy	5% of full-scale (2% with calibration) (25…55 °C) (77…131 °F)
Noise rejection	50/60 Hz
Common mode rejection	40 dB, DC to 60 Hz with Smoothing filter
Nominal impedance	14.1 kΩ (non-isolated)

DC Output (2080-LC10-12QBB)

Attribute	Value
User supply voltage, min	10 V DC
User supply voltage, max	26.4V DC
On-state voltage drop	1V @ max load current 2.5V @ max surge current
Current ratings (each point)	0.5A @ 55 °C, max 1.0A @ 30 °C, max 1.0 mA, min
Surge current, peak	4.0 A
Surge current, max duration	10 ms
Controller current	3 A
Turn-on- time, max	0.1 ms
Turn-off time, max	1.0 ms

Relay Outputs (2080-LC10-12AWA, 2080-LC10-12QWB, 2080-LC10-12DWD)

Attribute	Value
Output rating	Relay 00 & 01: 8 A @ 240V AC, 5A @ 24V DC, B300, R300 Relay 02 & 03: 4 A @ 240V AC, 2A @ 24V DC, C300, R150
Voltage, min	5V AC/DC
Voltage, max	250V AC, 30V DC @ rated current. See details on page 32 and 33.
Turn on time	15 ms
Turn off time	5 ms

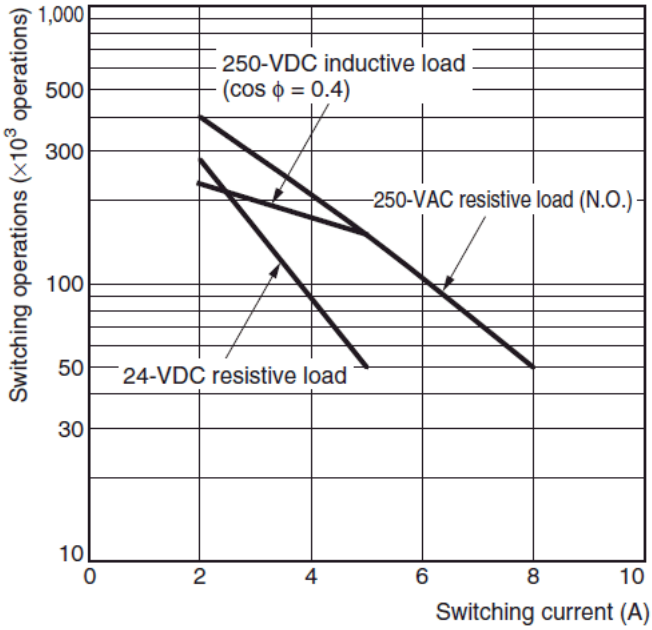
Relay Output Life

Attribute	Value
Mechanical	10,000,000 cyclces
Electrical with rated load	50,000 cycles

Embedded RTC

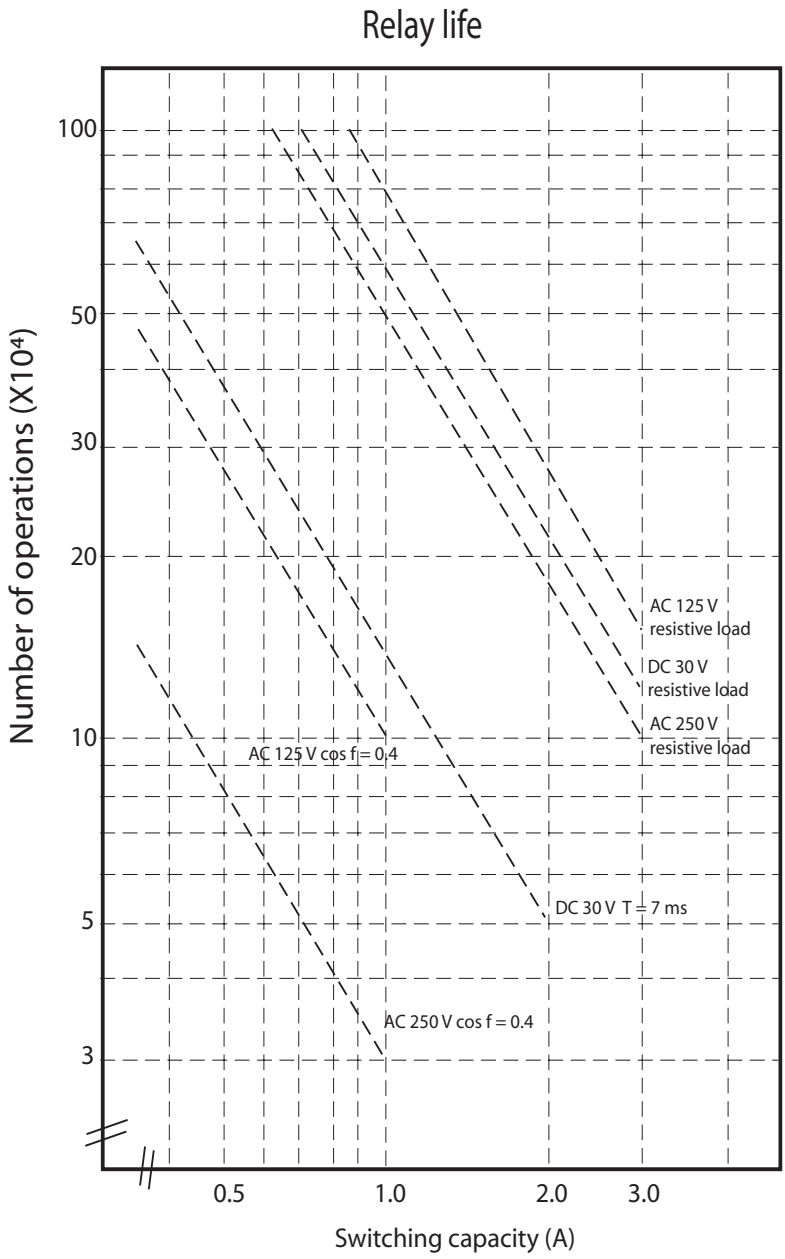
Attribute	Value
Resolution READ_RTC()	1 sec
Accuracy	± 12 sec/month @ 25 °C ± 160 sec/month@ 0…55 °C
Power off	Supercap — 5 days @ 40 °C or lower Supercap life — 5 years @ 40 °C, 14.5 years @ 25 °C

Micro810 High Current Relay Chart



Maximum Volts	IEC 947	Amperes		Amperes Continuous	Volt-Amperes	
		Make	Break		Make	Break
120V AC	AC-15	30 A	3 A	8 A	3600 VA	360 VA
240V AC	AC-15	15.0 A	1.5 A	8 A	3600 VA	360 VA
125V DC	DC-13	0.22 A		1.0 A	28 VA	
250V DC	DC-13	0.11 A		1.0 A	28 VA	
24V DC	DC-13	1.2 A		5.0 A	28 VA	

Micro810 Low Current Relay Chart



Maximum Volts	IEC 947	Amperes		Amperes Continuous	Volt-Amperes	
		Make	Break		Make	Break
120V AC	AC-15	15 A	1.5 A	4 A	1800 VA	180 VA
240V AC	AC-15	7.5 A	0.75 A	4 A	1800 VA	180 VA
125V DC	DC-13	0.22 A		1.0 A	28 VA	
24V DC	DC-13	1.2 A		4.0 A	28 VA	

Environmental

Attribute	Value
Temperature, operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0…55 °C (32…131 °F)
Temperature, surrounding air, max	55 °C (131 °F)
Temperature, storage	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock): -40…85 °C (-40…185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5...95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2 g @ 10…500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g (DIN Rail Mounted) 30 g (Panel Mounted)
Emissions	CISPR 11 Group 1, Class A
ESD immunity	IEC 61000-4-2: 4 kV contact discharges 8 kV air discharges
Radiated RF immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity	IEC 61000-4-4: ±2 kV at 5 kHz on power ports ±2 kV at 5 kHz on signal ports
Surge transient immunity	IEC 61000-4-5: ±1 kV line-line(DM) and ±2 kV line-earth(CM) on power ports ±1 kV line-line(DM) and ±2 kV line-earth(CM) on signal ports ±2 kV line-earth(CM) on shielded ports
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz
Voltage variation	IEC 61000-4-11: 60% dip for 5 and 50 periods on AC supply ports 30% dip for 0.5 period at 0° and 180° on AC supply ports 100% dip for 0.5 period at 0° and 180° on AC supply ports ±10% fluctuations for 15 min on AC supply ports >95% interruptions for 250 periods on AC supply ports

Certifications

Certification (when product is marked)(1)	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E322657. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E334470.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) See the Product Certification link at http://www.ab.com for Declaration of Conformity, Certificates, and other certification details.

Micro800 Programmable Controller External AC Power Supply

General

Attribute	Value
Dimensions, HxWxD	90 x 45 x 80 mm (3.55 x 1.78 x 3.15 in.)
Shipping weight	0.34 kg (0.75 lb)
Supply voltage range(1)	100V…120V AC, 1A 200…240V AC, 0.5A
Supply frequency	47…63 Hz
Supply power	24V DC, 1.6 A
Inrush current, max	24A @ 132V for 10 ms 40A @ 263V for 10 ms
Power consumption (Output power)	38.4W @ 100V AC, 38.4W @ 240V AC
Power dissipation (Input power)	45.1W @ 100V AC, 44.0W @ 240V AC
Isolation voltage	250V (continuous), Primary to Secondary: Reinforced Insulation Type Type tested for 60s at 2300V AC primary to secondary and 1480V AC primary to earth ground.
Output ratings	24V DC, 1.6A, 38.4W max.
Enclosure type rating	Meets IP20
Wire size	0.32... 2.1 mm² (22...14 AWG) solid copper wire or 0.32... 1.3 mm² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max
Terminal screw torque	0.5…0.6 Nm (4.4…5.3 lb-in) (using a Phillips-head or 2.5 mm (0.10in.) flat-blade screwdriver)
Wiring category(2)	2 – on power ports
Insulation stripping length	7 mm (0.28 in)
North American temp code	T4A

(1) Any fluctuation in voltage source must be within 85V...264V. Do not connect the adapter to a power source that has fluctuations outside of this range.

(2) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Running Programs with Micro800

This section provides a brief overview of running or executing programs with a Micro800 controller.

Overview of Program Execution

A Micro800 cycle or scan consists of reading inputs, executing programs in sequential order, updating outputs and performing communications housekeeping.

Program names must begin with a letter or underscore, followed by up to 127 letters, digits or single underscores. Use programming languages such as ladder logic, function block diagrams and structured text.

Up to 256 programs may be included in a project, depending on available controller memory. By default, the programs are cyclic (executed once per cycle or scan). As each new program is added to a project, it is assigned the next consecutive order number. When you start up the Project Organizer in Connected Components Workbench (CCW), it displays the program icons based on this order. You can view and modify an order number for a program from the program's properties. However, the Project Organizer does not show the new order until the next time the project is opened.

The Micro800 supports jumps within a program. Call a subroutine of code within a program by encapsulating that code as a User Defined Function Block (UDFB). Although a UDFB can be executed within another UDFB, a maximum nesting depth of five is supported. A compilation error occurs if this is exceeded.

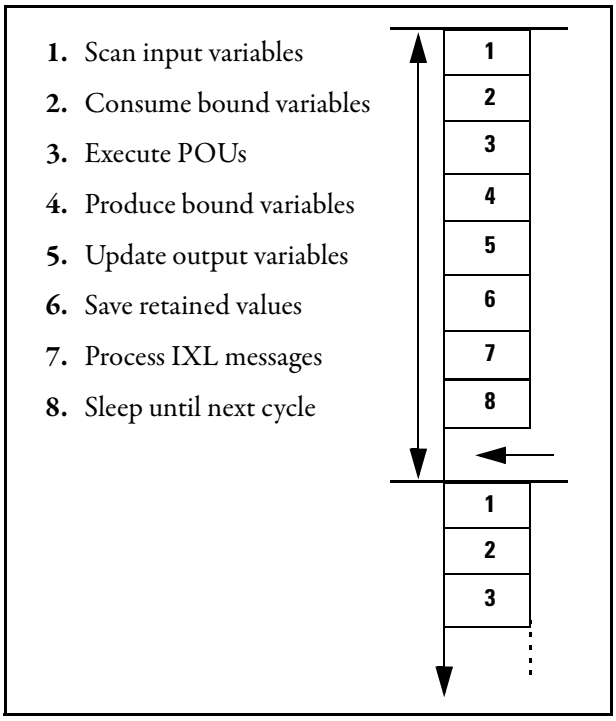
Alternatively, you can assign a program to an available interrupt and have it executed only when the interrupt is triggered. The User Fault Routine is the only interrupt available in Micro810 controllers. A program assigned to the User Fault Routine runs once just prior to the controller going into Fault mode.

The Global System Variables associated with cycles/scans are:

- __SYSVA_CYCLECNT - Cycle counter
- __SYSVA_TCYCURRENT - Current cycle time
- __SYSVA_TCYMAXIMUM - Maximum cycle time since last start.

Execution Rules

This section illustrates the execution of a program. The execution follows eight main steps within a loop. The loop duration is a cycle time for a program.



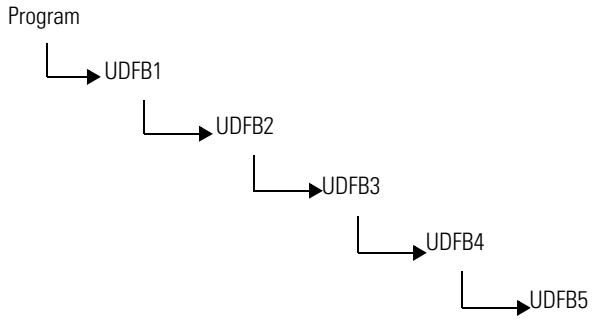
Guidelines and Limitations

Here are some guidelines and limitations to consider when programming a Micro800 controller using Connected Components Workbench (CCW) software:

- Each program/Program Organizational Unit (POU) can use up to 64 Kb of internal address space. It is recommended that you split large programs into smaller programs to improve code readability, simplify debugging and maintenance tasks.

- A User Defined Function Block (UDFB) can be executed within another UDFB, with a limit of 5 nested UDFBs. Avoid creating UDFBs with references to other UDFBs, as executing these UDFBs too many times may result in a compile error.

  Example of 5 nested UDFBs

- Structured Text (ST) is much more efficient and easier to use than Ladder Logic, when used for equations. if you are used to using the RSLogix500 CPT Compute instruction, ST combined with UDFB is a great alternative.
  As an example, for an Astronomical Clock Calculation, Structured Text uses 40% less Instructions.

  Display_Output LD:

  Memory Usage (Code) : 3148 steps
  Memory Usage (Data) : 3456 bytes

  Display_Output ST:

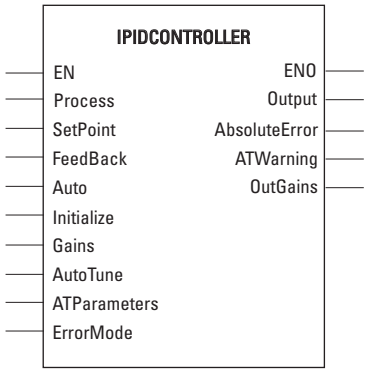
  Memory Usage (Code) : 1824 steps
  Memory Usage (Data) : 3456 bytes

- You may encounter an issue with downloading and compiling a program over a certain size. One workaround is to use arrays, especially if there are many variables.

Notes:

IPID Function Block

This function block diagram shows the arguments in the IPIDCONTROLLER function block.



The following table explains the arguments used in this function block.

IPIDCONTROLLER Arguments

Parameter	Parameter Type	Data Type	Description
EN	Input	BOOL	Function block enable When EN = TRUE, execute function. When EN = FALSE, do not execute function. Only applicable to LD, EN is not required in FBD programming.
Process	Input	REAL	Process value, measured from the output of controlled process.
SetPoint	Input	REAL	Set point value for desired process
Feedback	Input	REAL	Feedback signal, measured from control input to a process.
Auto	Input	BOOL	Operating modes of PID controller: • TRUE —controller runs in normal mode • FALSE — controller out value equals to feedback value
Initialize	Input	BOOL	A change in value (True to False or FALSE to TRUE) causes the controller to eliminate any proportional gain during that cycle. It Also initializes AutoTune sequences.
Gains	Input	GAIN_PID	Gains for IPIDCONTROLLER See GAIN_PID Data type

IPIDCONTROLLER Arguments

Parameter	Parameter Type	Data Type	Description
AutoTune	Input	BOOL	Start AutoTune sequence
ATParameters	Input	AT_Param	Auto tune parameters See AT_Param Data Type
ErrorMode	Input	DINT	Mode used to handle errors. Possible value are: • 0 — No error message ErrLog file. • 1 — Prints error message level 1 in ErrLog file. • 2 — Prints error message level 1 and level 2 in ErrLog file.
Output	Output	Real	Output value from the controller
AbsoluteError	Output	Real	AbsoluteError is the difference between Process value and set point value
ATWarnings	Output	DINT	Warning for the Auto Tune sequence. Possible value are: • 0 — No auto tune done • 1 — Auto tuning in progress • 2 — Auto tuning done • -1 — Error 1: Controller input “Auto” is TRUE, please set it to False • -2 — Error 2: Auto tune error, the ATDynaSet time expired
OutGains	Output	GAIN_PID	Gains calculated from AutoTune Sequences. See GAIN PID Data type
ENO	Output	BOOL	Enable out. Only applicable to LD, “ENO” is not required in FBD programming.

GAIN_PID Data Type

Parameter	Type	Description
DirectActing	BOOL	Types of acting: • TRUE – Direct acting • FALSE – Reverse acting
ProportionalGain	REAL	Proportional gain for PID (>= 0.0001)
TimeIntegral	REAL	Time integral value for PID (>= 0.0001)
TimeDerivative	REAL	Time derivative value for PID (>= 0.0)
DerivativeGain	REAL	Derivative gain for PID (>= 0.0)

AT_Param Data Type

Parameter	Type	Description
Load	REAL	Initial controller value for Auto tuning process.
Deviation	REAL	Deviation for auto tuning. This is the standard deviation used to evaluate the noise band needed for AutoTune (noise band = 3* Deviation)
Step	REAL	Step value for AutoTune. Must be greater than noise band and less than ½ load.
ATDynamSet	REAL	Auto Tune time (in seconds). Auto Tune process will be stopped when ATDynamSet time expires
ATReset	BOOL	Determines whether the output value is reset to zero after an AutoTune sequence: • True – Reset IPIDCONTROLLER output to zero after Auto tune process. • False – leaves output at load value

How to AutoTune

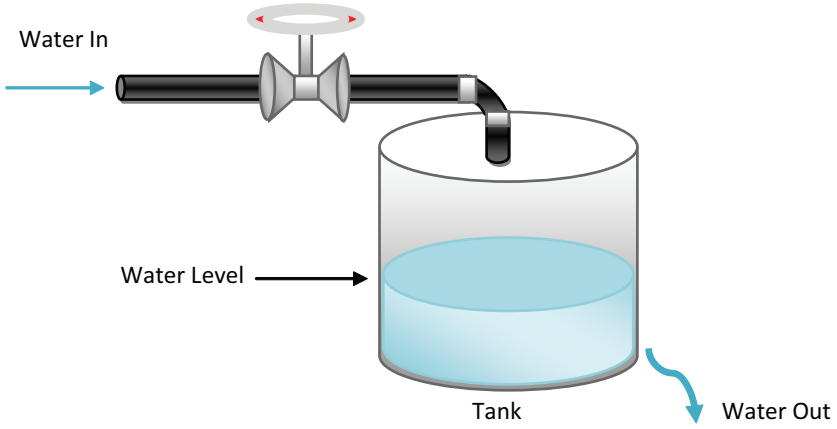
Before you continue, be sure that:

- the system is a stable system
- the "Auto" input to the IPIDCONTROLLER is set to false
- AT_Param is set

To autotune, perform these steps:

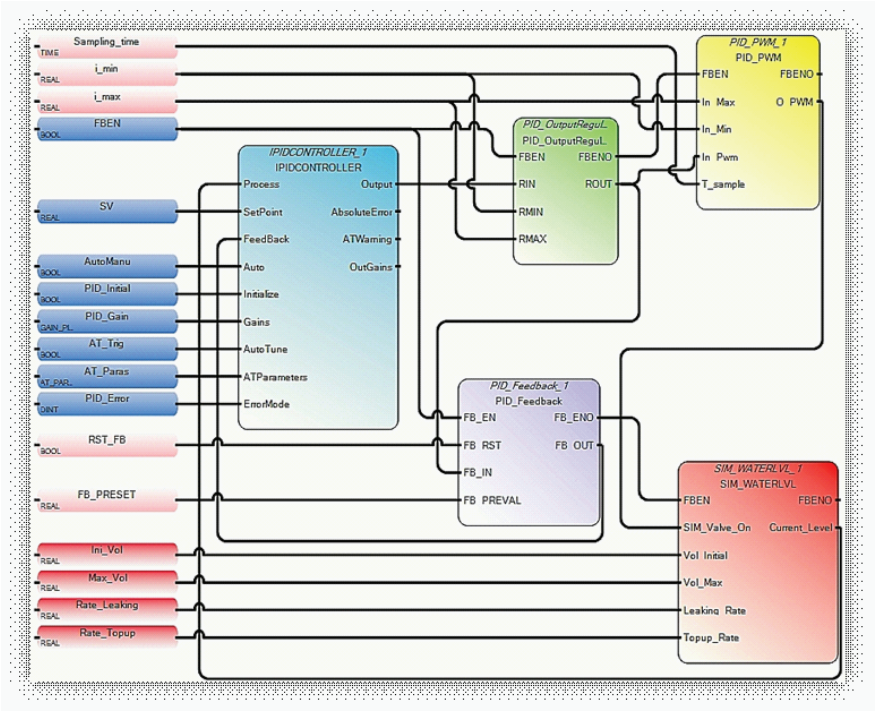
1. Set the "Initialize" input to "TRUE".
2. Set the "AutoTune" input to "TRUE".
3. Change the "Initialize" input to "FALSE".
4. Wait until the "ATWarning" output value changes to"2".
5. Get the tuned value from "OutGains".

PID Application Example



The illustration above shows a basic water level control system, to maintain a preset water level in the tank. A solenoid valve is used to control incoming water, filling the tank at a preset rate. Similarly, outflowing water is controlled at a measureable rate.

PID Code Sample



The illustration above shows sample code for controlling the PID application example shown before. Developed using Function Block Diagrams, it consists of a pre-defined function block, IPIDCONTROLLER, and four user-defined function blocks. These four are:

- PID_OutputRegulator
  This user-defined function block regulates the output of IPIDCONTROLLER within a safe range to ensure that there is no damage to the hardware used in the process.

  IF RMIN ≤ RIN ≤ RMAX, then ROUT = RIN,
  IF RIN < RMIN, then ROUT = RMIN,
  IF RIN > RMAX, then ROUT = RMAX.

- PID_Feedback
  This user defined function block acts as a multiplexer.

  IF "FB_RST" is false, FB_OUT=FB_IN;
  If "FB_RST" is true, then FB_OUT=FB_PREVAL.

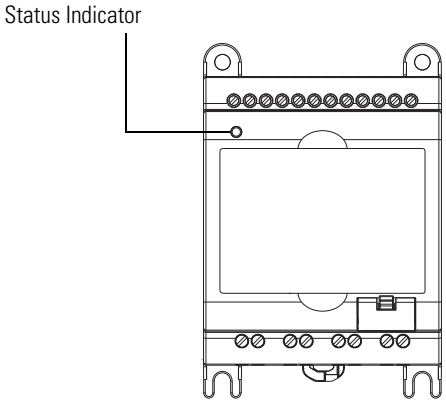
- PID_PWM
  This user defined function block provides a PWM function, converting a real value to a time related ON/OFF output.
- SIM_WATERLVL
  This user defined function block simulates the process depicted in the application example shown before.

Notes:

Troubleshooting

Status Indicators on the Controller

Micro810 Controllers

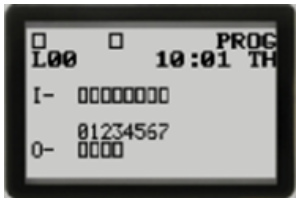


Status Indicator on the Controller

State	During Normal Operation	During Firmware Update or Program/Data Transfer
Off	No power applied to device, or in Fault mode	No power applied to device, or in Fault mode
Solid green	Device operating normally	Program transfer successful
Flashing green	Operating System error	Firmware update in progress

Status Indicators on the LCD Module

If you are using the LCD module, you can see input and output status indicators on the LCD module. .



Error codes

This section lists possible error codes for your controller, as well as recommended actions for recovery.

If an error persists after performing the recommended action, contact your local Rockwell Automation technical support representative. For contact information, go to http://support.rockwellautomation.com/MySupport.asp.

List of Error Codes for Micro800 controllers

Error Code	Description	Recommended Action
0xF000	The controller was unexpectedly reset due to a noisy environment or an internal hardware failure. The Micro800 controller program has been cleared.	Perform one of the following: • Download the program. See Wire Your Controller on page 17.
0xF001	The controller program has been cleared. This happened because: • a power-down occurred during program download or data transfer from the memory module. • the cable was removed from the controller during program download. • the RAM integrity test failed.	Perform one of the following: • Download the program using Connected Components Workbench. • Transfer the program using the memory module restore utility.
0xF002	The controller hardware watchdog was activated. The controller program has been cleared.	Perform the following: • Establish a connection to the Micro800 controller. • Download the program using Connected Components Workbench.
0xD00F	A particular hardware type (for example, embedded I/O) was selected in the user program configuration, but did not match the actual hardware base.	Perform one of the following: • Connect to the hardware that is specified in the user program. • Reconfigure the program to match the target hardware type.
0xF003	One of the following occurred: • The memory module hardware faulted. • The memory module connection faulted. • The memory module was incompatible with the Micro800 controller's firmware revision.	Perform one of the following: • Remove the memory module and plug it in again. • Obtain a new memory module. • Upgrade the Micro800 controller's firmware revision to be compatible with the memory module. For more information on firmware revision compatibility, go to http://www.rockwellautomation.com/support/firmware.html
0xF004	A failure occurred during the memory module data transfer.	Attempt the data transfer again. If the error persists, replace the memory module.
0xF005	The user program failed an integrity check while the Micro800 controller was in Run mode.	Perform one of the following: • Cycle power on your Micro800 controller. Then, download your program using Connected Components Workbench and start up your system. See Wire Your Controller on page 17.
0xF006	The user program is incompatible with the Micro800 controller's firmware revision.	Perform one of the following: • Upgrade the Micro800 controller's firmware revision using ControlFlash. • Contact your local Rockwell Automation technical support representative for more information about firmware revisions for your Micro800 controller. For more information on firmware revision compatibility, go to http://www.rockwellautomation.com/support/firmware.html

List of Error Codes for Micro800 controllers

Error Code	Description	Recommended Action
0xF010	The user program contains a function/ function block that is not supported by the Micro800 controller.	Perform the following: • Modify the program so that all functions/function blocks are supported by the Micro800 controller. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xF014	A memory module memory error occurred.	Reprogram the memory module. If the error persists, replace the memory module.
0xF015	An unexpected software error occurred.	Perform the following: 1. Cycle power on your Micro800 controller. 2. Build and download your program using Connected Components Workbench, and then reinitialize any necessary data. 3. Start up your system. See Wire Your Controller on page 17.
0xF016	An unexpected hardware error occurred.	Perform the following: 1. Cycle power on your Micro800 controller. 2. Build and download your program using Connected Components Workbench, and then reinitialize any necessary data. 3. Start up your system. See Wire Your Controller on page 17.
0xF020	The base hardware faulted or is incompatible with the Micro800 controller's firmware revision.	Perform one of the following: • Upgrade the Micro800 controller's firmware revision using ControlFlash. • Replace the Micro800 controller. • Contact your local Rockwell Automation technical support representative for more information about firmware revisions for your Micro800 controller. For more information on firmware revision compatibility, go to http://www.rockwellautomation.com/support/firmware.html
0xF021	The I/O configuration in the user program is invalid or does not exist in the Micro800 controller.	Perform the following: • Verify that you have selected the correct Micro800 controller from the Device Toolbox. • Correct the plug-in I/O module configuration in the user program to match that of the actual hardware configuration. • Recompile and reload the program. • Put the Micro800 controller on Run mode. • If the error persists, be sure to use Connected Components Workbench programming software to develop and download the program.
0xF022	The user program in the memory module is incompatible with the Micro800 controller's firmware revision.	Perform one of the following: • Upgrade the Micro800 controller's firmware revision using ControlFlash to be compatible with the memory module. • Replace the memory module. • Contact your local Rockwell Automation technical support representative for more information about firmware revisions for your Micro800 controller. For more information on firmware revision compatibility, go to http://www.rockwellautomation.com/support/firmware.html

List of Error Codes for Micro800 controllers

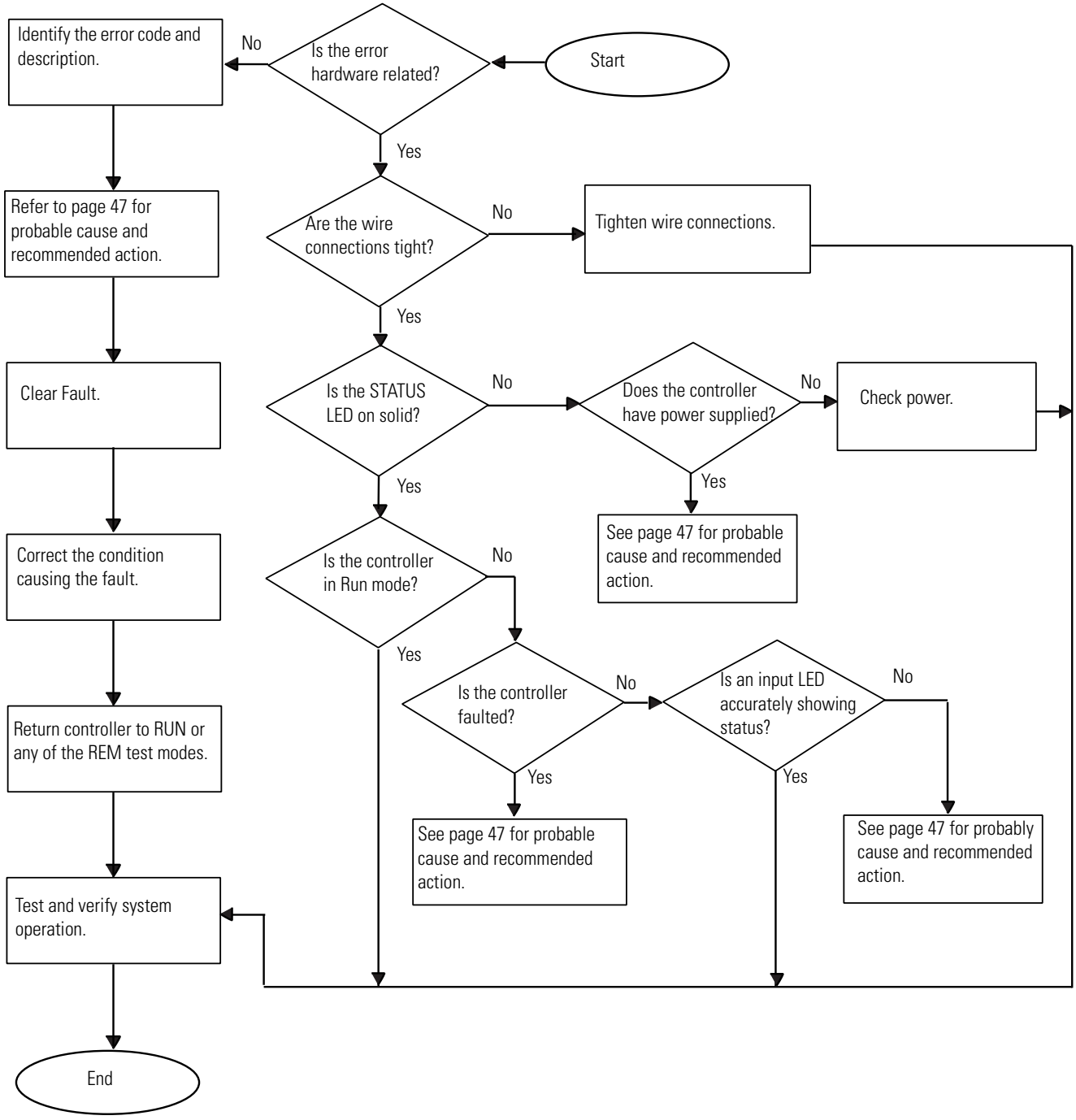
Error Code	Description	Recommended Action
0xF023	The controller program has been cleared. This happened because: • a power down occurred during program download or transfer from the memory module. • the Flash Integrity Test failed (Micro810 only).	• Download or transfer the program.
0xF050	The embedded I/O configuration in the user program is invalid.	Perform the following: • Correct the embedded I/O configuration in the user program to match that of the actual hardware configuration. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode. • If the error persists, be sure to use Connected Components Workbench programming software to develop and download the program.
For the following four error codes, z is the slot number of the plug-in module. If z = 0, then the slot number cannot be identified		
0xD011	The program scan time exceeded the watchdog timeout value.	Perform one of the following: • Determine if the program is caught in a loop and correct the problem. • In the user program, increase the watchdog timeout value that is set in the system variable _SYSVA_TCYWDG and then build and download the program using Connected Components Workbench.
0xF860	A data overflow occurred.	Perform the following: • Correct the program to ensure that there is no data overflow. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xF870	An index address was out of data space.	Perform the following: • Correct the program to ensure that there is no index address out of data space. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xF880	A data conversion error occurred.	Perform the following: Correct the program to ensure that there is no data conversion error. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xF888	The call stack of the controller cannot support the sequence of calls to function blocks in the current project. Too many blocks are within another block.	Change the project to reduce the quantity of blocks being called within a block.
0xF890	The LCD module was unexpectedly removed.	Perform one of the following: • Install your LCD module again. • Cycle power to the Micro800 controller.
0xF898	An error occurred in the user interrupt configuration for the plug-in I/O module.	Correct the user interrupt configuration for plug-in I/O module in the user program to match that of the actual hardware configuration.

List of Error Codes for Micro800 controllers

Error Code	Description	Recommended Action
0xF8A0	The TOW parameters are invalid.	Perform the following: • Correct the program to ensure that there are no invalid parameters. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xF8A1	The DOY parameters are invalid.	Perform the following: • Correct the program to ensure that there are no invalid parameters. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xF8A2	The HSC parameters are invalid.	Perform the following: • Correct the program to ensure that there are no invalid parameters. • Build and download the program using Connected Components Workbench. • Put the Micro800 controller on Run mode.
0xFFzz (zz indicates the last byte of the program number. Only program numbers up to 0xFF can be displayed. For program numbers 01x00 to 0xFFFF, only the last byte is displayed.)	A user-created fault from Connected Components Workbench has occurred.	Contact your local Rockwell Automation technical support representative if the error persists.

Controller Error Recovery Model

Use the following error recovery model to help you diagnose software and hardware problems in the micro controller. The model provides common questions you might ask to help troubleshoot your system. Refer to the recommended pages within the model for further help.



Calling Rockwell Automation for Assistance

If you need to contact Rockwell Automation or local distributor for assistance, it is helpful to obtain the following (prior to calling):

- controller type, series letter, revision letter, and firmware (FRN) number of the controller
- controller indicator status

Notes:

Quickstarts

This appendix covers some common tasks for the Micro810 controller. It includes the following quickstart instructions:

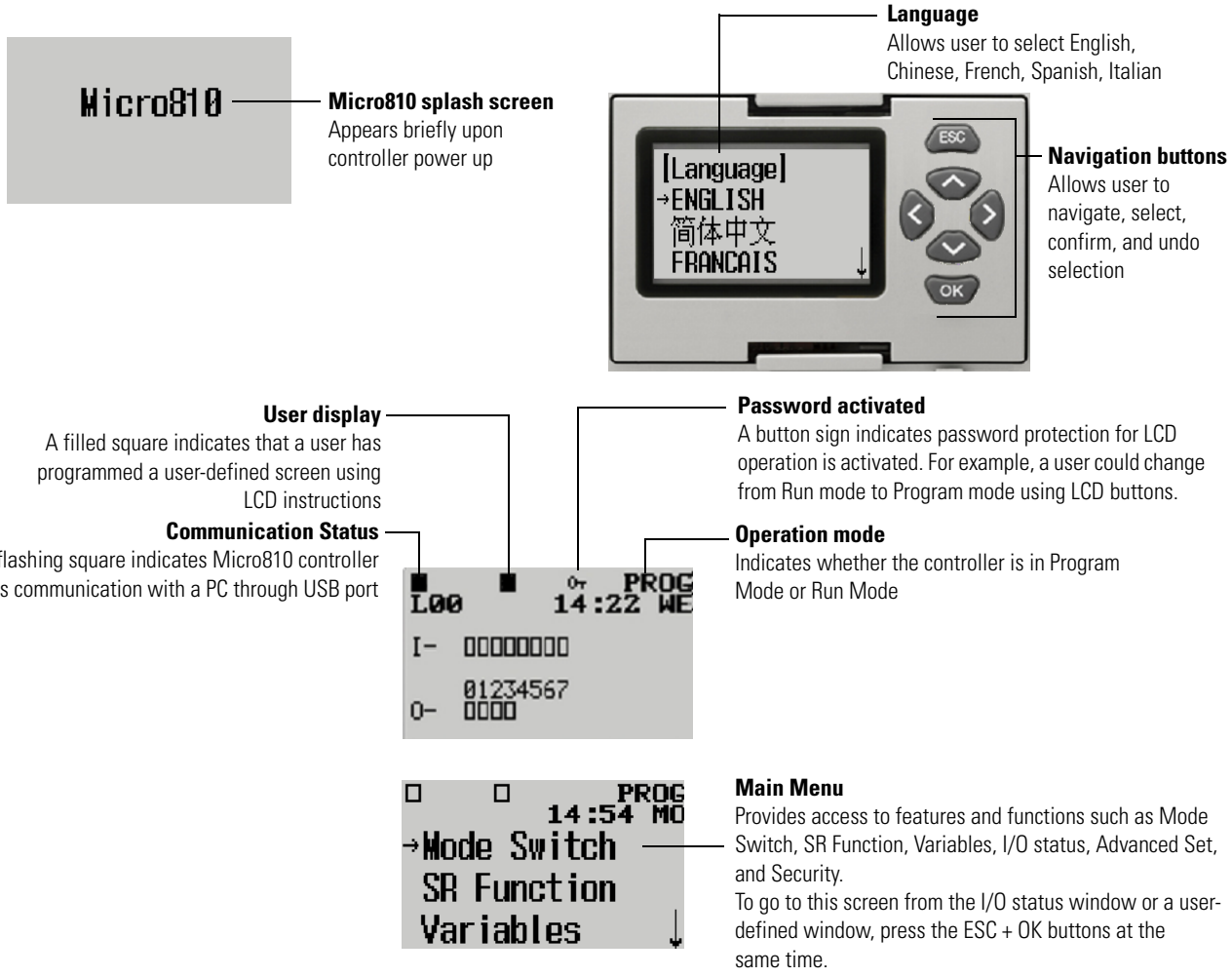
Topic	Page
Use the Micro810 Smart Relay Functionality	55
Flash Update the Micro800 Firmware	82
Establish Communication Between RSLinx and a Micro810 12-point controller through USB	86
Forcing I/O	88

Use the Micro810 Smart Relay Functionality

The Micro810 12-point (8 Inputs and 4 Outputs) controller comes with eight built-in Smart Relay function blocks that can be configured using the optional LCD Display and push buttons to control the four relay outputs, without using any software. These built-in function blocks are:

- CTU – Count Up
- TON – On-delay Timing
- DOY – Turning on an output if the value of real-time clock is in the range of Year Time setting.
- TOW – Turning on an output if the value of real-time clock is in the range of Day Time setting.
- CTD – Count Down
- TONOF – On-delay timing on a true rung, and then Off-delay timing on the false rung.
- TP – Pulse Timing
- TOF – Off-delay Timing

Navigate the LCD Display


Micro810
Micro810 splash screen
Appears briefly upon controller power up
Language
Allows user to select English, Chinese, French, Spanish, Italian
[Language]
→ENGLISH
简体中文
FRANCAIS
ESC
OK
Navigation buttons
Allows user to navigate, select, confirm, and undo selection
User display
A filled square indicates that a user has programmed a user-defined screen using LCD instructions
Communication Status
A flashing square indicates Micro810 controller has communication with a PC through USB port
Password activated
A button sign indicates password protection for LCD operation is activated. For example, a user could change from Run mode to Program mode using LCD buttons.
Operation mode
Indicates whether the controller is in Program Mode or Run Mode
L00 PROG
14:22 WE
I- 00000000
01234567
O- 0000
PROG
14:54 MO
→Mode Switch
SR Function
Variables
Main Menu
Provides access to features and functions such as Mode Switch, SR Function, Variables, I/O status, Advanced Set, and Security.
To go to this screen from the I/O status window or a user-defined window, press the ESC + OK buttons at the same time.

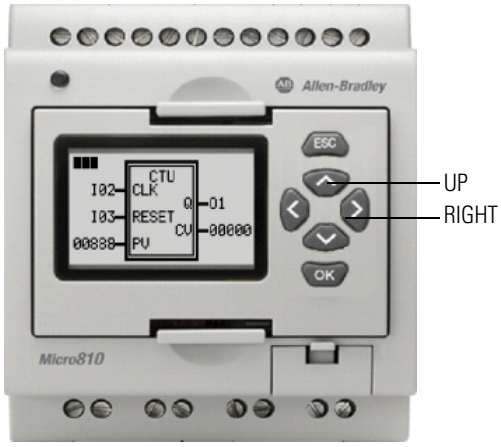
The following sections enable the user to configure and test each of the eight Smart Relay (SR) Functions available to the Micro810 controller.

Configure Count-Up (CTU)

This quickstart shows you how to configure the Count Up (CTU) function block.

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after power up.
2. The status display shows PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons buttons at the same time to go to the Main Menu.
3. Press the DOWN arrow button to navigate to SR Function. Press the OK button. The function block for controlling Output 0 is displayed.

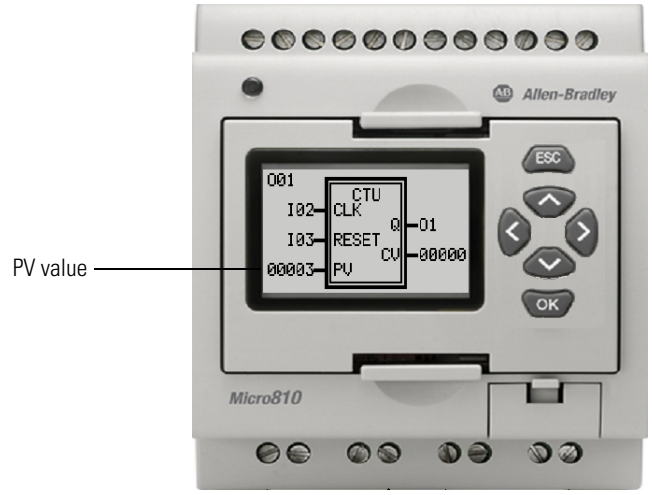
4. Press the UP arrow button once to navigate to the function block controlling Output 1.



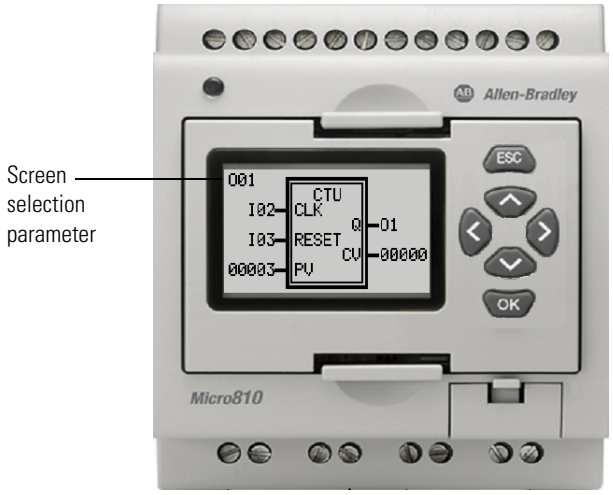
5. Press the RIGHT arrow button once. The instruction parameter field is selected and shows the CTU instruction.
6. Press the RIGHT arrow button once to select the CLK parameter field. This parameter triggers counting.

7. Press the RIGHT arrow button once to select the RESET parameter field. This parameter input forces a counter reset.
8. Press the RIGHT arrow button thrice to move to the first non-zero entry in the Preset Value (PV) parameter field.
   a. Press the UP arrow button twice to turn this digit to zero.
   b. Press RIGHT arrow button once to position to the next non-zero digit in the PV field. Press the UP arrow button twice to get the digit value of zero.

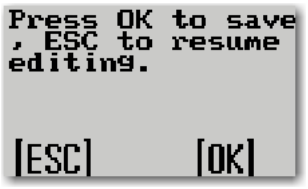
c. Press RIGHT arrow button once to go to the last digit. Press the DOWN arrow button five times to set the last digit to 3.



9. Press the RIGHT arrow button once to navigate to the screen selection parameter.



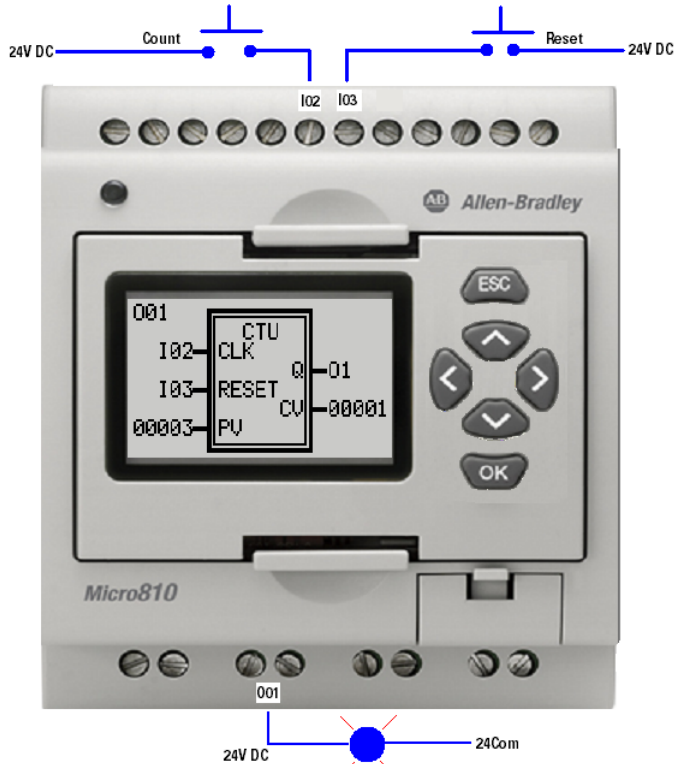
10. Press the OK button to submit the parameter changes.
A message prompts you to save the parameter changes. Press the OK button to save the changes.



Test the CTU Predefined Function

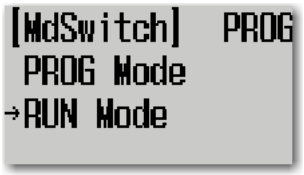
The CTU instruction increments the counter whenever input CLK makes a transition from low to high. The instruction compares the current value CV with

the preset value PV, and energizes output O1 when CV > PV. To test the operation, we connect a count push button to I02, a reset push button to I03, and a pilot light to output O01.

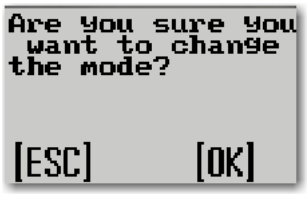


1. Press the ESC button to return to the Main Menu.
2. Press the UP arrow button once to go to Mode Switch. Press the OK button.

3. Press the DOWN arrow button once to select RUN mode. Press the OK button.

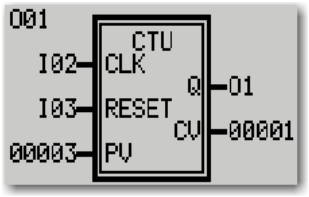


4. Press the OK button to confirm the RUN mode selection.

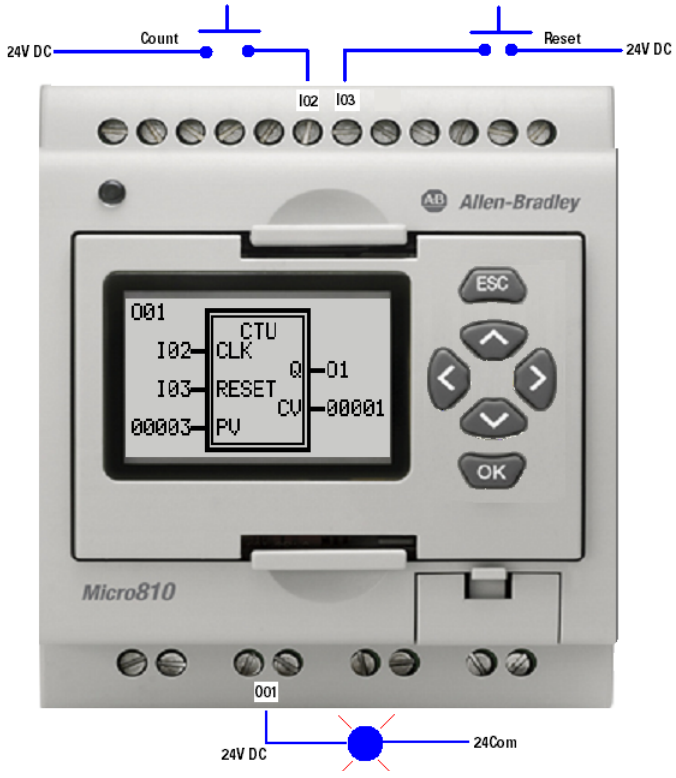


5. The screen indicates that the controller is in RUN mode. Press the ESC button to return to the Main Menu.

6. Press the DOWN arrow button once to navigate to SR Function.
   a. Press the UP arrow button once to go to CTU function block.



7. Press and release the count push button. The current value CV increments to 00001.



a. Press and release the count push button. The current value CV increments to 00002.

b. Press and release the count push button. The current value CV increments to 00003. Since the current value CV = present value PV, the output O1 is energized, and the pilot light turns on.

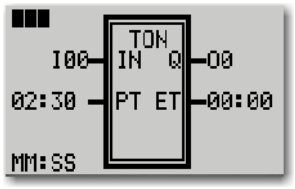
c. Press and release the Reset push button. The current value CV is reset to zero, and output O1 is de-energized. The pilot light turns off.

Configure On-delay Timing (TON)

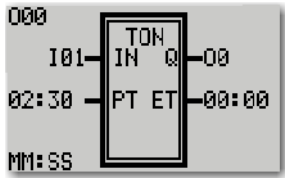
TON – Sample parameter configuration

Parameter Field	Configuration Value
Q	Q00
IN	I01
Time Resolution	SS:MS
PT	15:000

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after follow up.
2. The status display shows PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button to navigate to SR Function. Press the OK button. The function block for controlling Output 0 is displayed.

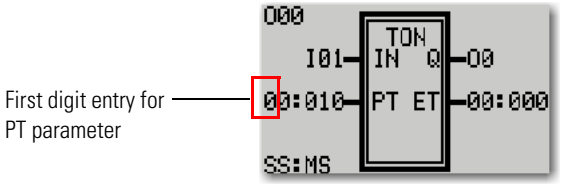


4. Press the RIGHT arrow button once to highlight instruction parameter field TON.
5. Press the RIGHT arrow button once to select the IN parameter value. This marks the start for on-delay timer.
6. Press the UP arrow button once to increment IN parameter value from I00 to I01.
7. Press the RIGHT arrow button once to select the Time-Resolution parameter field. This input determines the unit of on-delay timer.



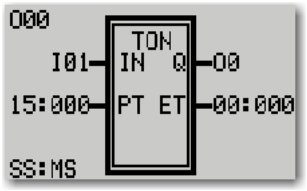
8. Press the DOWN arrow button once to change Time Resolution parameter to SS:MS.

9. Press the RIGHT arrow button once to select the first digit entry in PT parameter field.



   To change the PT parameter value to 15:000, do the following steps:

   a. Press the UP arrow button once to turn the first digit entry to 1.
   b. Press the RIGHT button arrow once to select the second entry in PT parameter field.
   c. Press the UP arrow button five times to increment the digit value to 5.
   d. Press the RIGHT button arrow twice to select the fourth digit entry in PT parameter field.
   e. Press the DOWN arrow button once to turn this digit value to zero.



10. Press the OK button to submit the parameter changes.
    A message prompts you to save the parameter changes. Press the OK button to save the changes.

Test the TON Predefined Function

The TON instruction starts an internal timer up to a given value when input (IN) makes a transition from low to high. The instruction compares the current Elapsed Time (ET) with the programmed time PT, and energize the output when ET = PT. To test the operation, we connect a push button to I01, and a pilot light to output O00.

1. Press the ESC button to return to the Main Menu.
2. Press the UP arrow button once to select Mode Switch. Press the OK button.
3. Press DOWN arrow button once to select RUN mode. Press the OK button.
4. A message prompts you to confirm RUN mode selection. Press the OK button.
5. Press the ESC button to return to the main menu. The main menu screen indicates that the controller is in RUN mode.

6. Press the DOWN arrow button once and select SR FUNCTION. Press the OK button. The TON function block to control Output 0 becomes available.
7. Press the push button connected to I01. ET starts to elapse.
8. When the current ET equals PT, output O00 is energized, and the pilot light turns on.

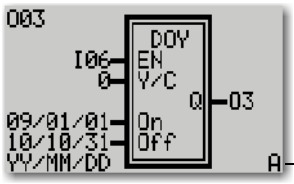
Configure DOY

DOY – Sample Parameter Configuration

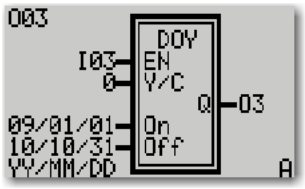
Parameter Field	Configuration Value
Q	Q03
Channel	A
EN	I03
Y/C	0
On	11/08/18 (YY/MM/DD)
Off	11/08/19 (YY/MM/DD)

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after power up.
2. The status display shows PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button once to select SR function. Press the OK button.
4. Press the DOWN arrow button once to navigate to the function block controlling Output 3 (DOY).

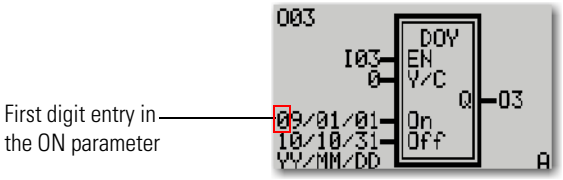
5. Press the RIGHT arrow button once to select the DOY instruction parameter field.
6. Press the RIGHT arrow button once. The CHANNEL parameter field is selected and it shows CHANNEL A.



7. Press the RIGHT arrow button to select the EN parameter field. Press the DOWN arrow button four times to change the EN parameter value to I03.

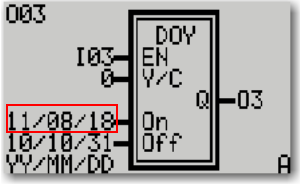


8. Press the RIGHT arrow button twice to select the first digit entry in the ON parameter field.

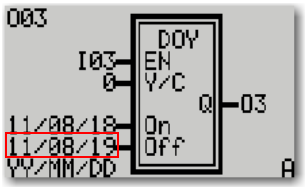


Change the On date settings to 11/08/18 (YY/MM/DD). To do this, follow these steps:

a. Press the UP arrow button once to get the digit value of 1.
b. Press the RIGHT arrow button once to select the second entry in the ON parameter field, then press the UP arrow button twice to turn this digit value to 1.
c. Press the RIGHT arrow button once to select the third and fourth digit entries in the ON parameter field, then press the DOWN arrow button five times to get the digit value 08.
d. Press the RIGHT arrow button once to select the fourth and fifth digit entries in the ON parameter field, then press the UP arrow button 17 times to get the digit value of 18.



9. Press the RIGHT arrow button once to select the first entry in the OFF parameter field.
   Change the Off date settings to 11/08/19 (YY/MM/DD). To do this, follow these steps:
   a. Press the RIGHT arrow button once to select the second entry in the OFF parameter field. Then, press the UP arrow button once to get the digit value of 1.
   b. Press the RIGHT arrow button once to select the third and fourth entries in the OFF parameter field, and press the UP arrow button seven times to get the digit value of 08.
   c. Press the RIGHT arrow button once to select the fourth and fifth digit entries in OFF parameter field, then press the UP arrow button 18 times to get the digit value of 19.



10. Press the OK button to submit the parameter changes.
    A screen confirms your request to save the parameter changes. Press the OK button to save the changes.

Test the DOY Predefined Function

The DOY instruction turns on the output if the value of the real-time clock is within the Year-Time setting on any of the four channels. To test the operation, we connect a push button to I03, and a pilot light to output O03.

Set up the Clock for Testing

1. Press the ESC button to return to the Main Menu.
2. Press the DOWN arrow button thrice to go to Advanced Set. Press the OK button.

3. Press the DOWN arrow button thrice to go to Clock Setup then press the OK button.
   Press the OK button again on Clock.

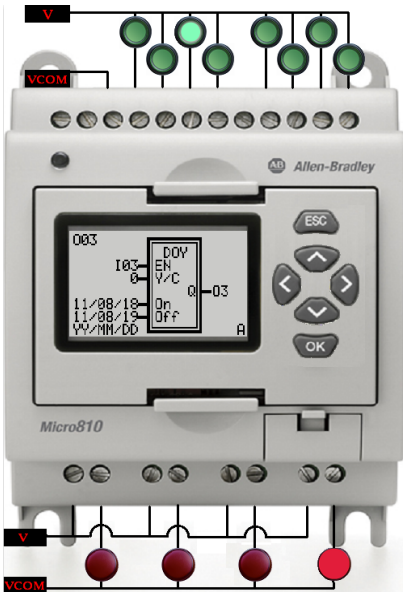
4. Press the RIGHT arrow button to navigate through Year, MM.DD, and HH:MM fields.
   Set the MM.DD field value to the On date established during configuration (11/08/18). Use the UP or DOWN arrow buttons to increase or decrease the digit values on the MM.DD field.
5. Go to the HH:MM field. Change the time setting to 23:59, or a minute before the configured Off date. Use the UP or DOWN arrow buttons to increase or decrease the digit values on the HH:MM field. Press the OK button after editing.

   Proceed to the test steps described below.

Test the DOY Function

1. Press the ESC button twice to return to the Main Menu.
2. Press the UP arrow button to select Mode Switch. Press the OK button.
3. Press the DOWN arrow button to go to RUN mode, then press the OK button.
   a. Press the OK button to confirm the switch to RUN mode.
4. Press the ESC button to return to the Main Menu. The screen indicates that the controller is in RUN mode.
5. Press the DOWN arrow button once to select SR FUNCTION. Press the OK button.
6. Press the DOWN arrow button once to get to Output 3 (DOY).

7. Press the push button connected to I03. If the value of RTC is in the range of Year-Time setting for CHANNEL A, then the pilot light turns on.



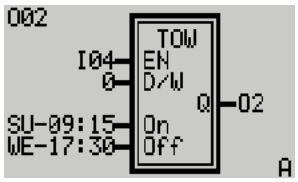
Configure TOW

TOW – Sample Parameter Configuration

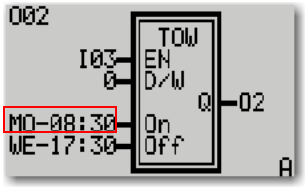
Parameter Field	Configuration Value
Q	Q02
Channel	A
EN	I03
D/W	0
On	M0-08:30
Off	M0-08:31

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after power up.
2. The I/O status display shows PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button once to select SR Function. Press the OK button. The function block for controlling Output 0 shows up.

4. Press the UP arrow button twice to navigate to the function block for Output 2 (TOW).

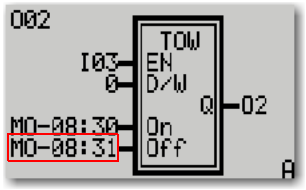


5. Press the RIGHT arrow button once to select the TOW instruction parameter field.
6. Press the RIGHT arrow button once to select CHANNEL parameter field. It shows CHANNEL A.
7. Press the RIGHT arrow button once to select the EN parameter field. Press the DOWN arrow button once to change the EN parameter value to I03.
8. Press the RIGHT arrow button once to select the D/W parameter field.
9. Press the RIGHT arrow button once to select the first entry in the ON parameter field.
   a. Press the UP arrow button once to change the value to "MO".
   b. Press the RIGHT arrow button once to select the first and second digit entries in the ON parameter field, and press the DOWN arrow button once to get the digit value of 08.
   c. Press the RIGHT arrow button once to select the third digit entry in the ON parameter field, and press the UP arrow button twice to get the digit value of 3.
   d. Press the RIGHT arrow button once to select the fourth digit entry in the ON parameter field, and press the DOWN arrow button 5 times to get the digit value of 0.



10. Press the RIGHT arrow button once to select the first entry in the OFF parameter field.
    a. Press the DOWN arrow button twice to change the value to "MO".
    b. Press the RIGHT arrow button once to select the second and third digit entries in the OFF parameter field, and press the DOWN arrow button nine times to get the digit value of 08.

c. Press the RIGHT arrow button twice to get to the fifth digit entry in the OFF parameter field, and press the UP arrow button once to get the digit value of 1.



11. Press the OK button to submit the parameter changes.
A screen confirms your request to save the parameter changes. Press the OK button to save the changes.

Test the TOW Predefined Function

The TOW instruction turns on output if the value of real-time clock is within the range of the Day-Time setting for any of the four channels. To test the operation, we connect a push button to I03, and a pilot light to output O02.

Set up the Clock for Testing

1. Press the ESC button to return to the Main Menu.
2. Press the DOWN arrow button thrice to go to Advanced Set. Press the OK button.

3. Press the DOWN arrow button thrice to go to Clock Setup then press the OK button.
Press the OK button again on Clock.

4. Press the RIGHT arrow button to navigate through Year, MM.DD, and HH:MM fields.
   Set the MM.DD field value to a date that falls on a Monday, as set in the Configure example. Use the UP or DOWN arrow buttons to increase or decrease the digit values on the MM.DD field.
5. Go to the HH:MM field. Change the time setting to 08:29, or a minute before the On time set. Use the UP or DOWN arrow buttons to increase or decrease the digit values on the HH:MM field. Press the OK button after editing.

Proceed to the test steps described below.

Test the TOW Function

1. Press the ESC button twice to return to the Main Menu.
2. Press the UP arrow button to select Mode Switch. Press the OK button.
3. Press the DOWN arrow button once to select RUN mode. Press the OK button.
4. Press the OK button to confirm the RUN mode selection.
5. The screen indicates that the controller is in RUN mode. Press the ESC button to return to the Main Menu.
6. Press the DOWN arrow button once and select SR FUNCTION. Press the OK button.
7. Press the UP arrow button twice for Output 2.

8. Press the push button connected to I03. If the value of RTC is in the range of Day-Time setting for CHANNEL A, the pilot light turns on.

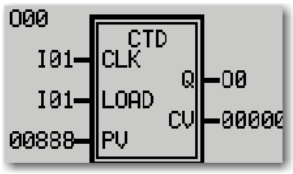
Configure Countdown (CTD)

CTD – Sample Parameter Configuration

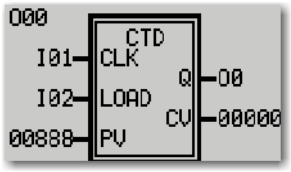
Parameter field	Configuration value
Q	Q00
CLK	I01
LOAD	I02
PV	00010

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after power up.
2. The status display shows the PROG status, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button once to select SR Function. Press the OK button. The function block for controlling Output 0 is displayed.
4. Press the RIGHT arrow button once to select the TON instruction parameter field.
5. Press the UP arrow button three times to change to CTD instruction.

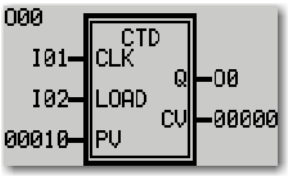
6. Press the RIGHT arrow button once to select the CLK parameter field. This is the trigger for counting.
   Press the UP arrow button once to change CLK parameter to I01.



7. Press the RIGHT arrow button once to select the LOAD parameter field. This input reloads the preset value PV.
   Press the UP arrow button once to select I02.



8. Press the RIGHT arrow button three times to move to the first non-zero entry on the PV (Preset Value for the counter) parameter field.
   a. Press the UP arrow button twice to change this digit to zero.
   b. Press the RIGHT arrow button once to get to the next non-zero digit in the PV field.
   c. Press the UP arrow button three times to get the digit value of 1.
   d. Press the RIGHT arrow button once to position to the next digit in the PV field.
   e. Press the UP arrow button twice to make this digit a zero.



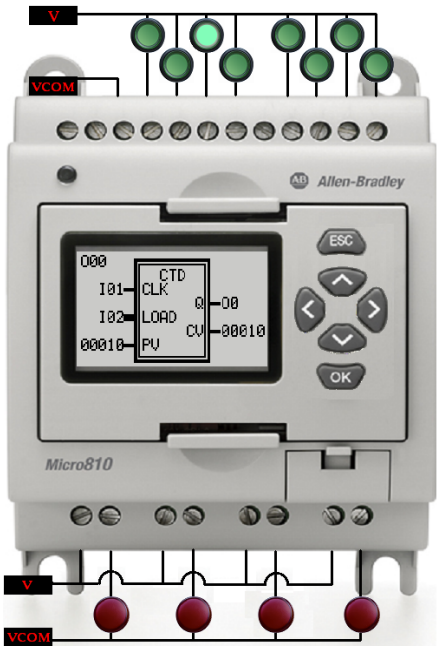
9. Press the OK button to submit the parameter changes.
   A screen confirms your request to save the parameter changes. Press the OK button to save the changes.

Test the CTD Predefined Function

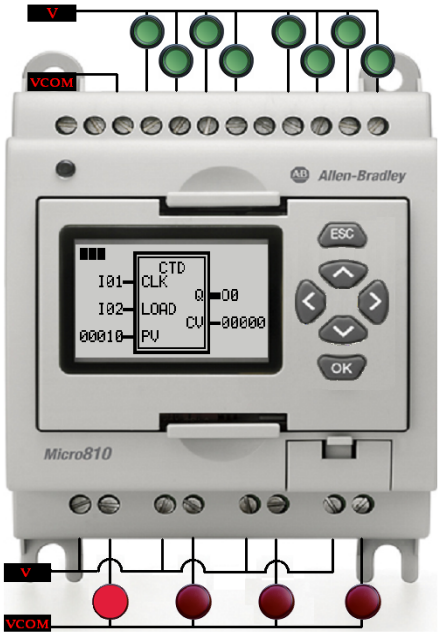
The CTD instruction decrements the counter from a given value down to 0 whenever input CLK makes a transition from low to high, and energizes the output when CV ≤ 0. To test the operation, we connect a count push button to I01, a load push button to I02, and a pilot light to output O00.

1. Press the ESC button to return to the Main Menu.

2. Press the UP arrow button once to select Mode Switch and press the OK button.
3. Press the DOWN arrow button once to select RUN mode. Press the OK button.
4. Press the OK button to confirm the RUN mode selection.
5. The screen indicates that the controller is in RUN mode. Press the ESC button to return to the Main Menu.
6. Press the DOWN arrow button once and press the OK button to select SR FUNCTION.
7. Press the load push button connected to I02. The current value CV reloads to 00010, and the pilot light turns off. Then, release the load push button.



8. Press and release the count push button connected to I01. The current value CV decrements to 00009.
   Repeat the step 8 nine times, until CV decrements to 00000.
   When CV = 0, the output O00 is energized, and the pilot light turns off.



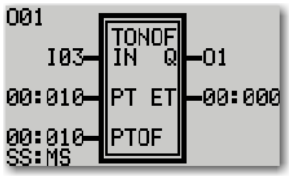
Configure TONOFF

TONOFF – Sample Parameter Configuration

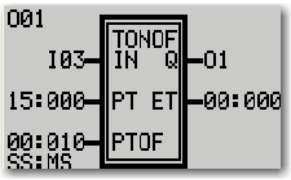
Parameter field	Configuration value
Q	Q01
IN	I03
Time Resolution	SS:MS
PT	15:000
PTOFF	20:000

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after power up.
2. The status display shows the PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button once to select SR Function. Press the OK button. The function block for controlling Output 0 is displayed.
4. Press the UP arrow button once to select Output 1 (CTU).
5. Press the RIGHT arrow button once to select the CTU instruction parameter field.

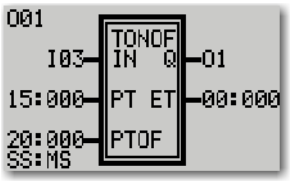
6. Press the DOWN arrow button twice to go to TONOFF instruction.
7. Press the RIGHT arrow button once to select the IN parameter field. This input marks the start for the internal timer.
   Press the UP arrow button once to change IN parameter value to I03.
8. Press the RIGHT arrow button once to select the Time-Resolution parameter field. This input determines the unit of internal timer.
   Press the DOWN arrow button once to change time setting to SS:MS.



9. Press the RIGHT arrow button once to select the first entry in PT parameter field.
   a. Press the UP arrow button once to get the digit value of 1.
   b. Press the RIGHT arrow button once to select the second digit entry in PT parameter field.
   c. Press the UP arrow button five times to get the digit value of 5.
   d. Press the RIGHT arrow button twice to select the fourth digit entry in PT parameter field.
   e. Press the DOWN arrow button once to get the digit a zero.



10. Press the RIGHT arrow button once to select the first digit entry in PTOF parameter field.
    a. Press the UP arrow button twice to get the digit value of 2.
    b. Press the RIGHT arrow button 3 times to go to the fourth digit entry for the PTOF parameter field.
    c. Press the DOWN arrow button once to make this digit a zero.



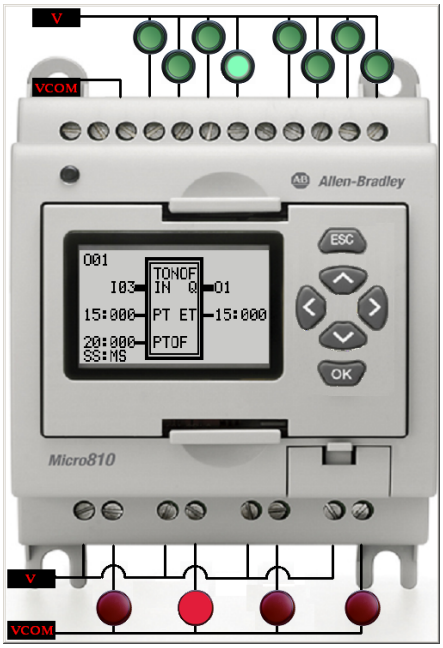
11. Press the OK button to submit the parameter changes.
    A screen confirms your request to save the parameter changes. Press the OK button to save the changes.

Test the TONOFF Predefined Function

The TONOFF instruction starts an internal timer up to a given value PT when input IN makes a transition from low to high, and energizes the output when ET = PT.

Restart the internal timer up to a given value PTOF when input IN makes a transition from high to low, and de-energize the output when EP=PTOF. To test the operation, we connect a push button to I03, and a pilot light to output O01.

1. Press the ESC button to return to the Main Menu.
2. Press the UP arrow button once to select Mode Switch. Press THE OK button.
3. Press the DOWN arrow button once to select RUN mode. Press the OK button.
4. Press the OK button to confirm the RUN mode selection.
5. The screen indicates that the controller is in RUN mode. Press the ESC button to return to the Main Menu.
6. Press the DOWN arrow button once to select SR FUNCTION. Press the OK button.
7. Press the UP arrow button once to select Output 1.
8. Press the push button connected to I03. The elapsed time ET starts to elapse.
9. When the current elapsed time ET = programmed time PT, the output O01 is energized, and the pilot light turns on.



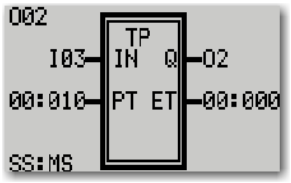
10. Release the push button connected to I03. The elapsed time ET restarts to elapse.
    When the current elapsed time ET = programmed time PTOF, the output O01 is de-energized, and the pilot light turns off.

Configure Pulse Timing (TP)

TP – Sample Parameter Configuration

Parameter Field	Configuration Value
Q	Q02
IN	I03
Time Resolution	SS:MS
PT	15:000

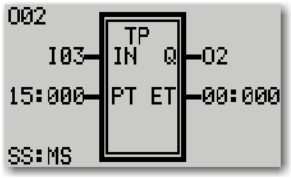
1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears.
2. The status display shows PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button once to select SR Function. Press the OK button. The function block for controlling Output 0 is displayed.
4. Press the UP arrow button twice to select Output 2 (TOW). To switch to TP instruction:
   a. Press the RIGHT arrow button once to select the TOW instruction parameter field.
   b. Press the DOWN arrow button four times to switch to TP instruction.
5. Press the RIGHT arrow button once to select the IN parameter field. This marks the start of the internal timer.
6. Press the RIGHT arrow button once to select the Time-Resolution parameter field. This input determines the unit of internal timer.
   Press the DOWN arrow button once to change time setting to SS:MS.



7. Press the RIGHT arrow button once to select the first entry in PT parameter field.
   a. Press the UP arrow button once to change this digit value to 1.
   b. Press the RIGHT arrow button once to select the second digit entry in PT parameter field.
   c. Press the UP arrow button five times to change this digit value to 5.

d. Press the RIGHT arrow button twice to select the fourth digit entry in PT parameter field.

e. Press the DOWN arrow button once to get the digit value of zero.



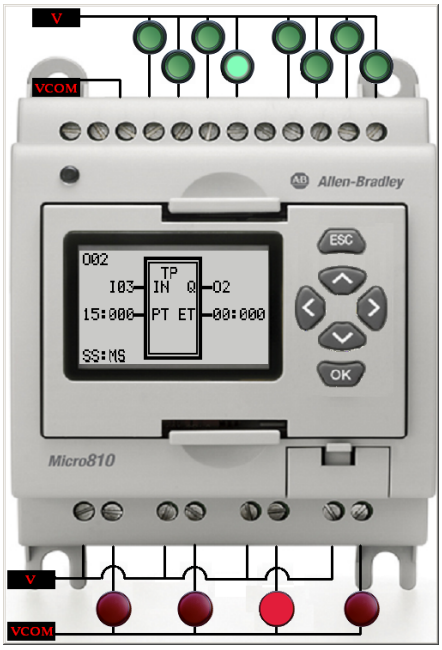
8. Press the OK button to submit the parameter changes.
   A screen confirms your request to save the parameter changes. Press the OK button to save the changes.

Test the TP Predefined Function

The TP instruction starts an internal timer when input IN makes a transition from low to high, and energizes the output at the same time. When the elapsed time ET increments up to the given value PT, it de-energizes the output. To test the operation, we connect a push button to I03, and a pilot light to output O02.

1. Press the ESC button to return to the Main Menu.
2. Press the UP arrow button to select Mode Switch. Press the OK button.
3. Press the DOWN arrow button to select RUN mode. Press the OK button.
4. Press the OK button to confirm the RUN mode selection.
5. The screen indicates that the controller is in RUN mode. Press the ESC button to return to the Main Menu.
6. Press the DOWN arrow button to select SR FUNCTION. Press the OK button.
7. Press the UP arrow button twice to select Output 2.

8. Press the push button connected to I03. The elapsed time ET starts to elapse and the pilot light turns on.



When the current elapsed time ET = programmed time PT, the output O02 is de-energized, and the pilot light turns off.

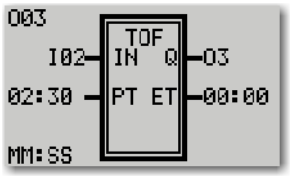
Configure TOF

TOF – Sample Parameter Configuration

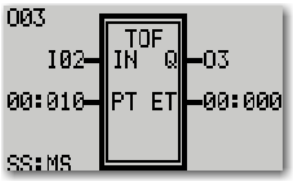
Parameter field	Config value
Q	Q03
IN	I02
Time Resolution	SS:MS
PT	15:000

1. Power up the Micro810 controller.
   The Micro810 splash screen briefly appears after power up.
2. The status display shows PROG mode, the day and time, and the I/O status. Press the ESC and OK buttons at the same time to navigate to the Main Menu.
3. Press the DOWN arrow button once to select SR Function. Press the OK button. The function block for controlling Output 0 is displayed.
4. Press the DOWN arrow button once to select Output 3.
   a. Press the RIGHT arrow button once to select the DOY instruction parameter field.
5. Press the UP arrow button once to go to TOF instruction.

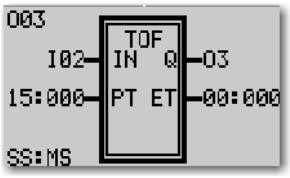
6. Press the RIGHT arrow button once to select the IN parameter field. This marks the start for the Off-delay timer.
   Press the DOWN arrow button four time to change IN parameter value to I02.



7. Press the RIGHT arrow button once to select the Time-Resolution parameter field. This input determines the unit of Off-delay timer.
   Press the DOWN arrow button once to change time parameter setting to SS:MS.



8. Press the RIGHT arrow button once to select the first digit entry for the PT parameter field.
   a. Press the UP arrow button once to get the digit value of 1.
   b. Press the RIGHT arrow button once to select the second entry in PT parameter field.
   c. Press the UP arrow button five times to get the digit value of 5.
   d. Press the RIGHT arrow button twice to select the fourth digit entry in PT parameter field.
   e. Press the DOWN arrow button once to get the digit value of zero.



9. Press the OK button to submit the parameter changes.
   A screen confirms your request to save the parameter changes. Press the OK button to save the changes.

Test the TOF Predefined Function

The TOF instruction energizes the output when input IN makes a transition from low to high. Then, it starts the Off-delay timer when input IN makes a transition from high to low. When the elapsed time ET increments up to the

given value PT, it de-energizes the output. To test the operation, we connect a push button to I02, and a pilot light to output O03.

1. Press the ESC button to return to the Main Menu.
2. Press the UP arrow button once to select Mode Switch. Press the OK button.
3. Press the DOWN arrow button once to select RUN mode. Press the OK button.
4. Press the OK button to confirm the RUN mode selection.
5. The screen indicates that the controller is in RUN mode. Press the ESC button to return to the Main Menu.
6. Press the DOWN arrow button once to select SR FUNCTION. Press the OK button.
7. Press the DOWN arrow button once to select Output 3.
8. Press the push button connected to I02, the output O03 is energized and the pilot light turns on.

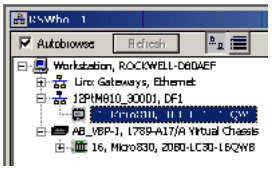
9. Release the push button connected to I02. The ET parameter starts to elapse. When the current ET = PT, the output O03 is de-energized, and the pilot light turns off.

Flash Update the Micro800 Firmware

This quickstart shows you how to flash update the firmware in a Micro800 controller using ControlFLASH. ControlFLASH is installed or updated with the latest Micro800 firmware when Connected Components Workbench software is installed on your computer.

Before attempting to flash update your controller, ensure that the controller is in Program mode. For more information on enabling program mode, see Access the Main Menu on page 27.

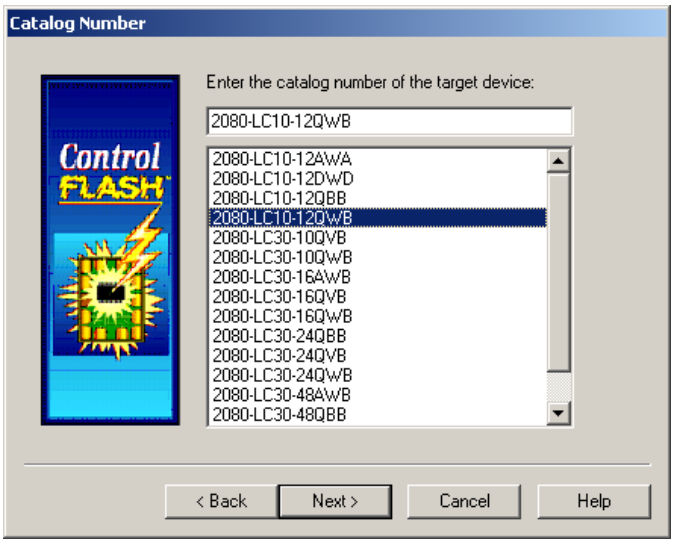
1. First verify successful RSLinx Classic communications with your Micro800 controller via USB using RSWho (Micro810 12-pt. uses the 12PtM810_xxxxx driver and the Micro830 controller uses the AB_VBP-x driver).



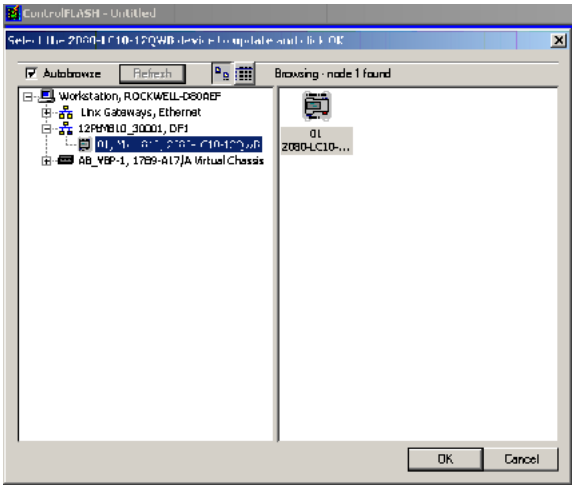
2. Start ControlFLASH and click Next.

ControlFLASH - Untitled
ControlFLASH 9.00.015
Welcome to ControlFLASH
Welcome to ControlFLASH, the firmware update tool. ControlFLASH needs the following information from you before it can begin updating a device.
1. The Catalog Number of the target device.
2. The Network Configuration parameters (optional).
3. The Network Path to the target device.
4. The Firmware Revision for this update.
Control FLASH
View Log
< Back
Next >
Cancel
Help

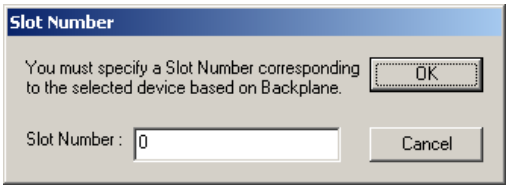
3. Select the catalog number of the Micro800 controller that you are going to update and click Next.



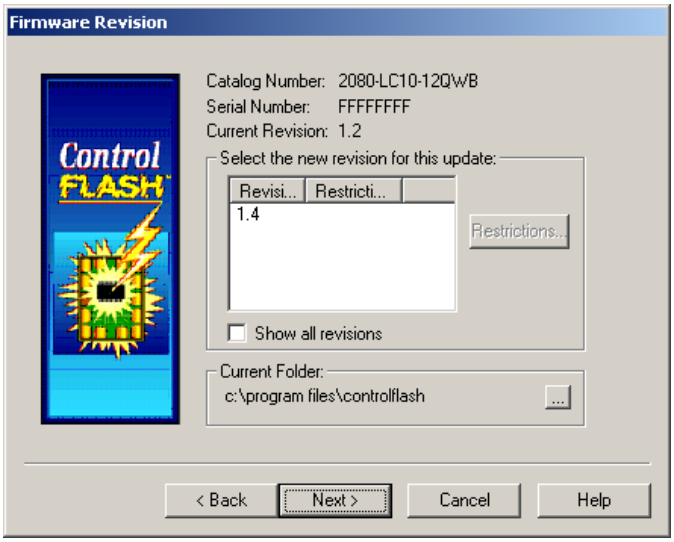
4. Select the controller in the browse window and click OK.

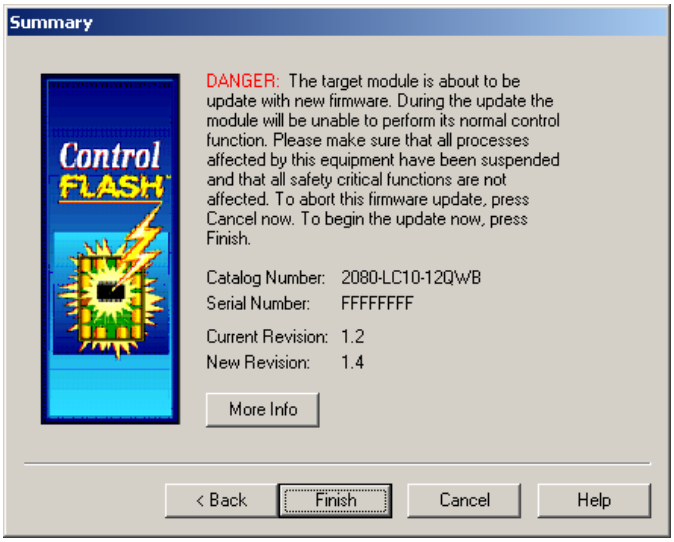


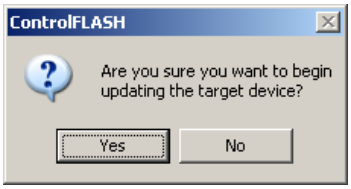
5. If you see the following screen (Micro810 controller only), leave the Slot Number at 0 and click OK.



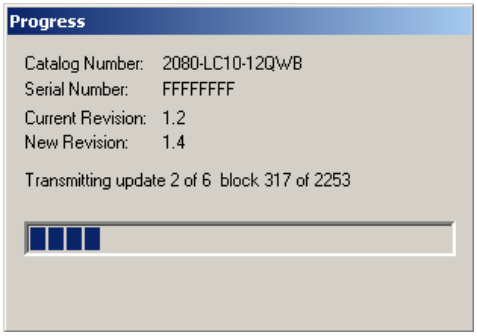
6. Click Next to continue, and verify the revisions. Click Finish, and Yes to initiate the update.



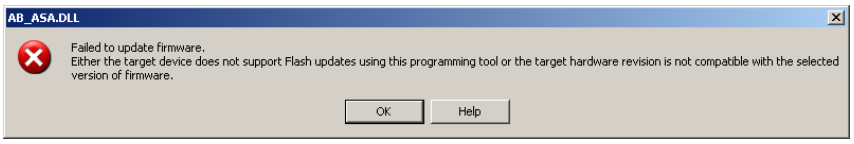

Summary
DANGER: The target module is about to be update with new firmware. During the update the module will be unable to perform its normal control function. Please make sure that all processes affected by this equipment have been suspended and that all safety critical functions are not affected. To abort this firmware update, press Cancel now. To begin the update now, press Finish.
Catalog Number: 2080-LC10-12QWB
Serial Number: FFFFFFFF
Current Revision: 1.2
New Revision: 1.4
More Info
< Back
Finish
Cancel
Help



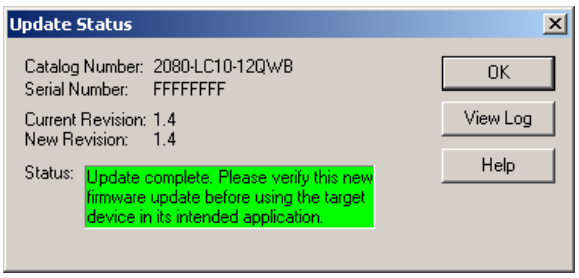
The next screen shows the download progress.



7. If you see an error message instead, check to see if the controller is faulted or in Run mode. If so, clear the fault or switch to Program mode, click OK and try again.


AB_ASA.DLL
Failed to update firmware.
Either the target device does not support Flash updates using this programming tool or the target hardware revision is not compatible with the selected version of firmware.
OK
Help

8. When the flash update is complete, you see a status screen similar to the following. Click OK to complete the update.


Update Status
Catalog Number: 2080-LC10-12QWB
Serial Number: FFFFFFFF
Current Revision: 1.4
New Revision: 1.4
Status: Update complete. Please verify this new firmware update before using the target device in its intended application.
OK
View Log
Help

Establish Communication Between RSLinx and a Micro810 12-point controller through USB

This quickstart shows you how to get RSLinx RSWho to communicate with a Micro810 12-point controller through USB.

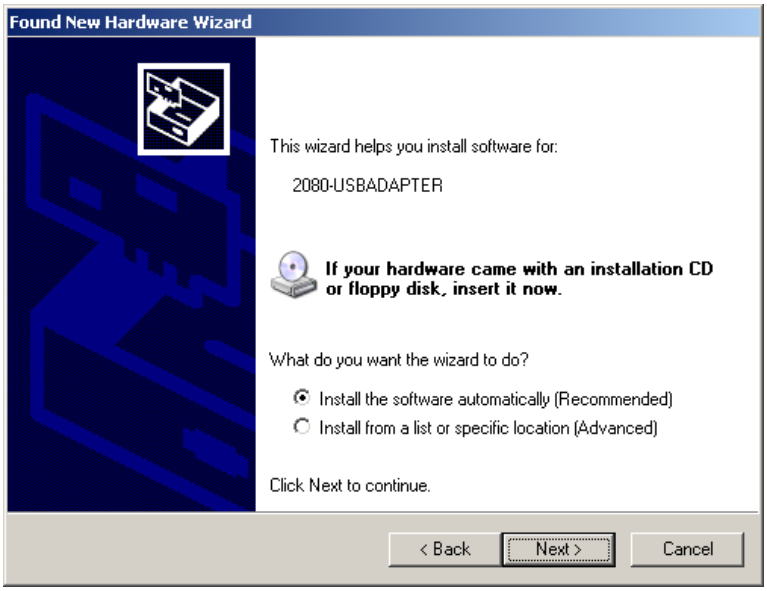
Normally, RSLinx Classic is installed as part of the Connected Components Workbench software installation process. The minimum version of RSLinx Classic with full Micro800 controller support is 2.57, build 15 (released March 2011).

1. Power up the Micro810 12-point controller.
2. Plug the 2080-USBADAPTER into the Micro810 and then plug the USB A/B cable directly between your PC and the adapter.

3. Click No, not this time and Next when you are prompted to search for software through Windows Update.

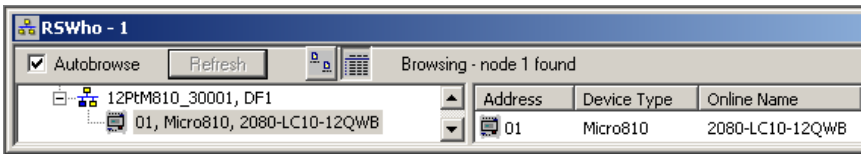
Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

4. Click Next to continue.


Found New Hardware Wizard
This wizard helps you install software for:
2080-USBADAPTER
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

5. Click Finish after Found New Hardware Wizard completes installation of the software.

6. Open RSLinx Classic and run RSWho by clicking the icon.
7. The Micro810 controller shows up under the 12PtM810 driver.



8. You can now use ControlFLASH or CCW to communicate with the Micro810 controller.

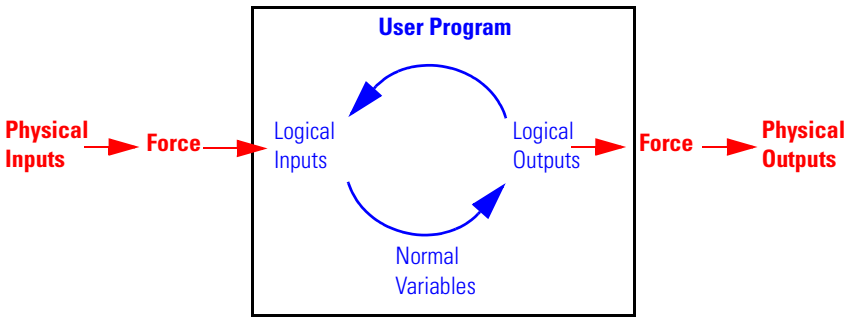
Forcing I/O

Forcing is only possible with I/O and does not apply to user defined variables and non-I/O variables.

Inputs are logically forced, so LED status indicators do not show forced values, but the inputs in the user program are forced.

Unlike inputs, outputs are physically forced, so LED status indicators do show forced values. The user program does not use forced values.

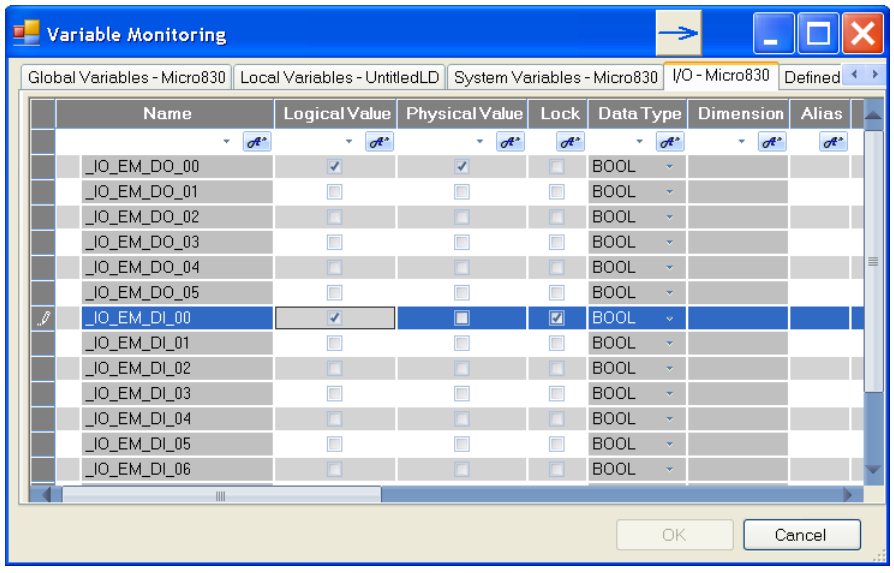
The following diagram illustrates forcing behaviour.



- LED status indicators always match the phyical value of I/O
- Normal, non-physical internal variables cannot be forced

Check if Forces (locks) are Enabled

If Connected Components Workbench (CCW) is available, check the Variable Monitor while debugging online. Forcing is performed by first Locking an I/O variable and then setting the Logical Value for Inputs and Physical Value for Outputs. Remember you cannot force a Physical Input and cannot force a Logical Output.



In many cases, the front of the controller is not visible to the operator and CCW is not online with the controller. If you want the force status to be visible to the operator, then the User Program must read the force status using the SYS_INFO function block and then display the force status on something that the operator can see, such as the human machine interface (HMI), or stack light. The

following is an example program in Structured Text.

```
(* Read System Information including Force Enable bit *)
SYS_INFO_1(TRUE);

(* Turn on Warning Light if Forces are Enabled *)
If SYS_INFO_1.Sts.ForcesInstall = TRUE THEN
    _IO_EM_DO_05 := TRUE;
ELSE
    _IO_EM_DO_05 := FALSE;
END_IF;
```

If the front of the controller is visible, and not blocked by the cabinet enclosure, Micro830 and higher controllers have a Force LED indicator.

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Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.
At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

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